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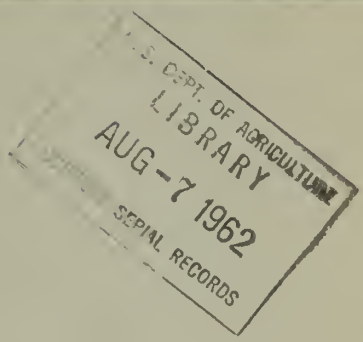

FIRE CONTROL NOTES

A PERIODICAL DEVOTED TO THE TECHNIQUE OF FOREST FIRE CONTROL

FOREST SERVICE • U. S. DEPARTMENT OF AGRICULTURE

FORESTRY cannot restore the American heritage of natural resources if the appalling wastage by fire continues. This publication will serve as a channel through which creative developments in management and techniques may be communicated to and from every worker in the field of forest fire control.

Volume 13 Number 1

FIRE CONTROL NOTES

A Quarterly Periodical Devoted to the TECHNIQUE OF FOREST FIRE CONTROL

The value of this publication will be determined by what Federal, State, and other public agencies, and private companies and individuals contribute out of their experience and research. The types of articles and notes that will be published will deal with fire research or fire control management: Theory, relationships, prevention, equipment, detection, communication, transportation, cooperation, planning, organization, training, fire fighting, methods of reporting, and statistical systems. Space limitations require that articles be kept as brief as the nature of the subject matter will permit.

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AN INFORMAL STUDY OF POWER-SAW FIRES

L. L. Colvill, *Assistant Chief,* and A. B. Everts, *Equipment Engineer*
Division of Fire Control, Region 6, U. S. Forest Service

The increase in the number of power-saw fires during the last few years is viewed with alarm. In an effort to determine *how* these fires were starting and what should be done about them, an informal study was undertaken.

Forests submitted detailed information on individual fires. Manufacturers, mechanics, fallers, and buckers were interviewed. Carbon tests were made on mufflers and the one known spark arrester for power saws. Bulletins bearing on the subject were studied. One of these, University of California Bulletin No. 577, "Spark Arresters for Motorized Equipment," has been considered by later investigators to be the basic study as to the size and temperature of carbon that sets fires.

This paper deals primarily with power saws, but certain aspects of the study are applicable to all internal combustion engines and their fire-setting potentialities.

A tabulation was made of power-saw fires reported by the forests, including the make and model of the saw (if this were known) and all other pertinent information. Not tallied were a number of small fires immediately put out and on which information was lacking.

Of 29 fires reported, 8 were caused by hot mufflers or exhaust pipes coming in contact with flammable material; 6 by backfires of power-saw engine; and 3 by gasoline spills (how the gasoline was ignited was not determined). The specific cause of the other 12 was not pinpointed.

Seven of the fires were listed as having started from bucking saws, and 1 from falling saws. The remaining 21 did not have indicated which type of operation was responsible.

Sizes of the fires varied from smoldering material to 1,080 acres. Largest single suppression cost was $17,910.

The theory has been advanced that some mufflers are adequate spark arresters. An adequate spark arrester is considered to be one that will trap 90 percent of the test carbon, size A (carbon which passes a 14-mesh Tyler screen and is retained by a 28-mesh Tyler screen), and not set up more than a stated amount of back pressure as measured in water-inches.

Professor Henry F. Gauss of the University of Idaho Engineering Experiment Station recommends that for arresters on tractors the back pressure should not exceed 10 water-inches. The Society of Automotive Engineers Spark and Flame Arrester Committee states, ". . . No allowable back pressure is to be specified since it is felt that each engine manufacturer is best able to determine the back pressure which his engine can stand." Generally, it is believed back pressure in power saws should not exceed 4 to 6 water-inches.

In order to obtain information on the adequacy of mufflers as spark arresters, tests were run on three makes. A measured amount of carbon, size A, was fed into the air stream below the muffler. The amount that blew through was recovered and weighed back. Results were as follows:

Muffler:	Carbon		
	Fed in (grams)	*Recovered (grams)*	*Efficiency (percent)*
X	10	10	0
Y	10	9	10
Z:			
First test	10	6	40
Second test	25	18.5	26

Muffler Z was the largest of all mufflers and the one most likely, by its construction, to be effective. Muffler test conclusions are: Mufflers are not adequate spark arresters; all makes of mufflers tested got hot; and raw gasoline spilled on a hot muffler did not ignite.

The University of California study indicated that there is considerable risk from carbon sparks emitted from a 28-hp. tractor, but information was lacking on the danger of fire starting from carbon sparks emitted from power saws. Only one commercial spark arrester for power saws is manufactured, to our knowledge. The following two methods were used to test this spark arrester (fig. 1).

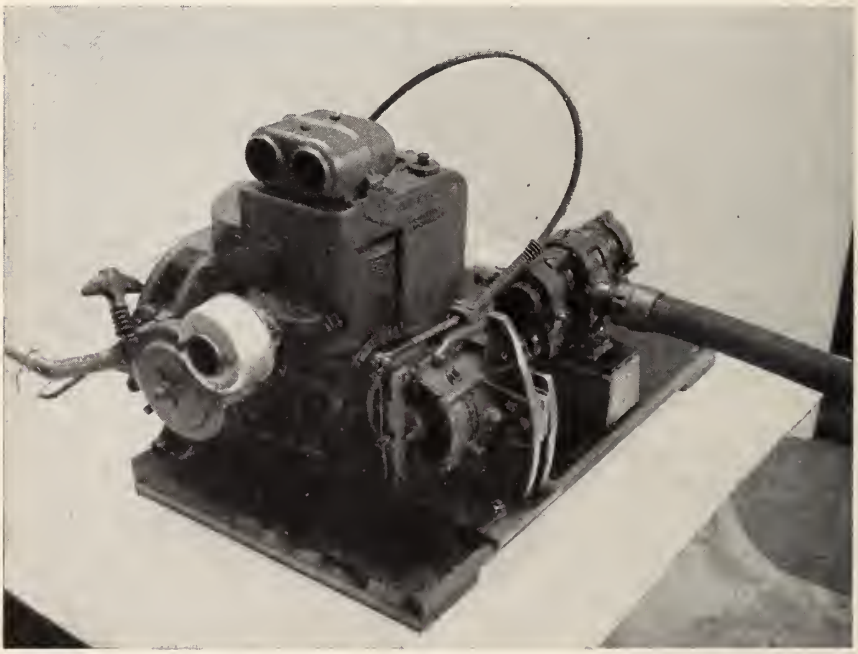

FIGURE 1.—To simulate conditions under which a power saw would ordinarily be working, a rotary gear pump was driven by the engine during the spark arrester tests.

1. Procedure was the same as that used on the mufflers. Back pressure was 6 water-inches. The arrester was mounted in three positions with the following results:

	Carbon		
	Fed in (grams)	*Trapped in arrester (grams)*	*Efficiency (percent)*
Arrester position:			
Vertical and up	25	23.3	93.2
Horizontal	25	22.5	90.0
Vertical and down	25	23.3	93.2

2. An 11-hp., 2-cycle, heavy-duty power-saw engine properly maintained with spark arrester attached was operated continuously for 8 hours under load comparable to field use. The engine speed was increased suddenly at frequent intervals and observation made on quantity, size, and distance sparks were emitted from the engine. The results were as follows:

a. The sudden increase in speed of the engine produced a flurry of light candescent sparks that glowed for a fraction of a second. Most of them were out before reaching the table. A very few of the heavier ones extended a distance of 3 to 4 feet from the engine and were still red when they reached the table but only long enough to be observed.

b. No carbon was trapped in the arrester.

c. The louver separator inside the arrester was hot enough to produce a red glow. The heat did not warp or otherwise damage the spark arrester.

d. The heat coming through the arrester ignited a rag held 1 inch from the exhaust.

e. Drops of gasoline placed on the spark arrester did not ignite.

Following this test, the engine was run with the regular muffler installed and with it removed. The engine was speeded up and then slowed down in an effort to produce sparks. It was observed that the largest number of candescent sparks occurred when the engine operated without a muffler or spark arrester, and no difference occurred in the quantity and size of candescent sparks emitted with the engine operating with a muffler or a spark arrester attached.

Engine backfiring is listed as one of the principal causes of power-saw fires. Several forests reported such fires; in some cases, the backfire ignited spilled gasoline. During laboratory tests attempts were made to cause backfires by alternately speeding up and slowing the engine. Only one or two relatively minor backfires resulted. A backfire seems most likely to occur when the engine is first started, or just before it comes to a dead stop.

Carbonization does occur in power saws. Mechanics for the distributors of three different makes of saws showed mufflers with their ports nearly closed by caked carbon to one of the co-authors.

CONCLUSIONS

1. Power-saw mufflers are not adequate spark arresters.

2. The one spark arrester tested satisfactorily passed the "dry run" efficiency test. The superiority of the spark arrester over the muffler appeared minor when tested on an operating engine.

3. Spark arresters or mufflers will not prevent fires caused by hot exhaust, backfires, or heat from the arrester or muffler in contact with flammable material.

4. Engines which exhaust against a log, or downward onto forest fuels, are more of a hazard than engines which exhaust in other directions.

5. Fire-setting potentialities are inherent in the operation of all makes of power saws.

6. Good maintenance, clean exhaust ports, proper grade of oil, and proper oil and gasoline mixture decreases the fire-setting potentialities of power saws.

7. The amount of carbon, of a size that will start fires, emitted from a properly maintained power-saw engine of the type tested was negligible. The presence of caked carbon in the exhaust port could be hazardous.

8. Some makes of saws are more subject to gasoline leaks than others.

9. Power bucking saws are more of a fire hazard than falling saws principally because of the more hazardous fuel in which they are working and the position of the saw when operating.

10. Based upon the limited statistics available, the authors rate the probable specific cause of any ten power-saw fires as follows:

Exhaust heat coming in contact with flammable material	3
Hot muffler, or arrester, or tail pipe contacting flammable material	3
Backfiring of engine	2
Candescent carbon sparks	1
Miscellaneous, including friction of the chain, short in ignition systems, etc.	1

The information obtained from this study led Region 6 to establish the policy that a spark arrester or a muffler will be required on all power-saws operating on national-forest lands.

SUGGESTED PREVENTIVE MEASURES

A prevention program directed toward reducing the number of power-saw fires suggests three avenues of approach:

Manufacturers.—Continue efforts with the manufacturers to encourage them to work on design changes which will:

1. Eliminate gasoline leaks.
2. Provide muffler insulation so that flammable material cannot come in direct contact with the muffler. In many of the makes of saws this would not be difficult to do. A cylinder of lightweight material, properly vented, around the muffler should provide this safety feature.
3. Change the exhaust so that it will be directed away from log being cut or the fuels on the ground.

Power-saw operators.—Power-saw operators can do much to prevent power-saw fires as follows:

1. After filling tank, move saw before starting. Fill tank on bare ground, if practical.
2. Do not wait for the engine to run out of gasoline before filling the tank. If the engine stops while the saw is in the tree, it is usually difficult to remove as it is frequently hemmed in by wedges. If the tank is filled in place and gasoline is spilled, the combination of sawdust, gasoline, and frequently oil is a hazard which may cause a fire and loss of the saw if an engine backfire should occur when the saw is started again.

3. Use the grade of oil and the oil and gasoline mixture recommended by the manufacturer of the saw. This will minimize formation of carbon.
4. Keep engine clean of sawdust and flammable material.
5. Keep muffler or spark arrester on the saw and in good condition.
6. Keep spark plugs and connections tight.
7. Clear flammable material from in front of the exhaust discharge—such as moss on log being bucked.
8. Keep fire extinguisher or shovel at hand at all times.

Forest officers.—Forest officers can best aid the prevention effort by carrying on a positive educational program to acquaint all concerned with the fire-setting potentialities of power saws by:

1. Informal discussions in the field with power-saw operators.
2. Informal presentation of known facts to the bull bucks, woods superintendents, and managers.
3. Wide distribution to all forest personnel of the facts brought out in this and other studies.

Fire Control Notes Distribution and the 1951 Questionnaire

The revision of the mailing lists for Fire Control Notes has given us an opportunity to analyze its distribution to recipients other than U. S. Forest Service officers. The total number of names is 460, separated as follows: U. S. Department of Agriculture, 22; U. S. Department of the Interior (mostly Indian Service, Bureau of Land Management, and National Park Service), 117; other Federal agencies, 33; State agencies (mostly State and extension foresters), 85; schools and libraries, 98; organizations and private companies and individuals, 67; Canadian government units, schools, libraries, and organizations, 37; Mexico, 1. In addition to these, there are 71 names on the foreign mailing list, and the Government Printing Office supplies 450 copies to 311 addresses on a paid subscription list and 275 copies to its list of depository libraries.

Of the 544 questionnaires sent out 456 were returned. The types of article found most interesting and useful were indicated on 118 questionnaires. The selections, as some replies pointed out, were determined by official responsibilities and personal interests. More than half noted equipment development and use as of primary interest, and more than a third selected methods, techniques, and planning in fire control. Some of the other types of articles of interest dealt with weather, safety, training, prevention and presuppression activities, fire research, fire behavior, distribution and causes of fires, case histories of specific fires and their analysis, and grassland fire problems and their solution. One type of article mentioned, and its value will be recognized by everyone, was that presenting ideas which could be put to use by fire control men in the field without elaborate plans or considerable expense.

Some 97 respondents found the bibliography of fire control literature helpful enough to say so. On the other hand, 19 said no or that they didn't use it.

Several suggestions for improvement were made, such as more coverage of the problems of private companies and how they have been solved; new ideas and methods of prevention, what produces results, and why; additional articles on fire-weather relationships, replanting brush land, fire and reseeding, wildlife destruction, and controlled or prescribed burning; and more short items.

To the question on suggestions for improvement 80 made brief comment, and 39 added other remarks. Most of these, to our gratification, were very complimentary. However, to maintain Fire Control Notes at a high degree of usefulness will require the active participation of many individuals directly and indirectly concerned with fire problems.—W. P. Everard and E. A. Hanson, *Washington Office Division of Information and Education, U. S. Forest Service.*

FIRE EXTINGUISHERS FOR USE WITH POWER SAWS

A. B. Everts, *Equipment Engineer,*
Division of Fire Control, Region 6, U. S. Forest Service

A rather wide difference of opinion exists among field men as to the efficiency of various kinds of fire extinguishers for use with power saws. This article briefs the results of an informal study on the subject, retaining the key points of difference.

In selecting a fire extinguisher for use with power saws, one must consider the size of the extinguisher and the type of fire to be encountered. An extinguisher carried by fallers and buckers should be small, not over one quart in size. Buckers and, to a lesser extent, fallers work in flammable flash fuels. The types of fires they may encounter involve gasoline, forest fuels, or both gasoline and forest fuels. Only one type of fire extinguisher will effectively handle all three of these fires—a foam extinguisher. The smallest foam extinguisher is the 2½-gallon size, obviously too large to be considered.

In testing extinguishers, we tried to simulate actual field conditions. An old pump was used to represent the power-saw engine. The pump was placed on a layer of dry grass in one test and on shredded paper in still another test. A half pint of Diesel oil was poured over the pump and the ground fuel. Results were as follows:

Dry chemical is one of the most effective extinguishing agents on the market for gasoline and electrical fires, but it is of little value for fires in forest fuels. Dry chemical extinguishes by smothering, and, in order to get this effect, the chemical must be expelled and diffused in a cloud under high pressure, usually by CO_2 or nitrogen gas. Sprinkling the chemical on the fire will not do the job, and the pressurized extinguisher is too heavy to be considered.

Carbon tetrachloride, one quart (hereafter referred to as CTC). CTC is a vaporizing liquid. The speed of vaporizing is in relation to the heat of the fire. CTC is designed for use on gasoline and electrical fires and, like dry chemical, is of little value on surface fires of any depth. In the tests it was possible to get the fire out on the pump by walking around it, all the while working the CTC extinguisher. The fire in the grass and paper was not extinguished; it was checked for a moment and then took off again.

Small chloro-bromo-methane (or CBM) extinguisher. There are at least two makes of this new type extinguisher on the market. They are small, about the size of a two-cell flashlight, and contain not less than 8 ounces of CBM by weight. In tests, this extinguisher did a fair job on gasoline fires but not comparable to the one-quart CTC, principally because of the small amount of fluid. It was ineffective on the surface fuel. In a power-saw fire, where gasoline is involved, fire is apt to be on all sides of the engine. The fire on one side can be extinguished, but as you move to the other side, the fire flashes back again—and somewhere in this process you run out of fluid.

The CTC used in the small CBM extinguisher seemed just as effective as CBM. There is a point of interest here—the manufacturers of vaporizing-liquid extinguishers (with two exceptions) have desired reach or projection in their extinguishers. They have, therefore, concentrated on a straight

stream. In the small CBM extinguishers the discharge pattern is a spray. This pattern, while limiting the reach, would seem to bring about quicker vaporizing, which may account for the seemingly superior effectiveness of CBM over CTC. However, as stated, this superiority was not noticeable to the writer when CTC was used in the same extinguisher.

In another test ordinary water used in the small CBM extinguisher did a better job of extinguishing the surface fire than either CTC or CBM.

Advantages of the small CBM extinguisher are: Initial cost is cheap; they can be refilled in company shop or on the ground (one type only—other type is traded in for a full one); they are effective as a "first aid" extinguisher on a *small* gasoline fire.

The disadvantages are: They do not have enough fluid to handle any but a *small* gasoline fire. They are of very limited value on a fire involving forest fuels. Being CO_2 pressured, they cannot be used in a position much above the horizontal, because the gas will escape while the fluid remains in the bottle. Unless a cap is carried over the valve or the carrying bracket is used, it is possible for the valve to be slightly "cracked" and the extinguisher lose its pressure without this fact being known.

Since neither the CTC nor the CBM extinguisher is very effective on forest fuels, and since a rather high percentage of fires start in this material, a shovel might well provide the best protection. A shovel can be used to throw dirt to smother a gasoline fire and to dig a line to control a ground fire. It can also be used to clear flammable material from in front of the engine exhaust, and at times to prepare better footing for saw operators.

On one west-side operation visited last summer, the writer was told by the fallers that the first job, when moving into a new stand of timber, was to buck out the windfalls. When this was being done, the fallers carried a shovel to dig out under the log so as to protect the saw. If the fallers can carry a shovel to aid them in their work, it would seem logical that they could carry one for fire protection. The buckers, working alone, would have a more legitimate "beef" against carrying a shovel.

Some forest officers in the field stated the small CBM extinguishers were effective for putting out power-saw fires; others, that they were of little value. This is understandable since the effectiveness of the extinguisher would vary with the intensity of the fire and the type of fuel in which it was burning.

One report stated, ". . . had about five power-saw fires, all small. All were extinguished with the . . . (small CBM) extinguisher. The largest of these required about four extinguishers to put the fire out." Four extinguishers will not usually be available to work on one fire. Several others felt that "there is not sufficient volume in the container to put out a fire of any size." Still others suggested the shovel in place of an extinguisher.

The choice, then, would seem to be among the following: Small CBM extinguisher, with CBM or CTC fluid; one-quart CTC extinguisher; shovel; shovel *and* one or the other of the extinguishers.

All things considered, the following policy is being put in effect by Region 6 until information is received that indicates the desirability of a change:

"Gasoline power saws will be equipped with a *chemical-pressurized* fire extinguisher of not less than 8 *ounces* capacity, by weight. A *shovel* may be substituted for the extinguisher when in the judgment of the district ranger it will be equally as effective in putting out fires."

CARRYING CASE FOR SF HANDI-TALKIE

FRANCIS W. WOODS

Communications Officer, Region 4, U. S. Forest Service

Boyd Leonard, Staff Fire Control Assistant, and Carl Gaver, Assistant Ranger of the Salmon National Forest, have developed a very satisfactory case for the protection and transportation of the SF handi-talkie. Considering the initial cost, difficulty of repair, and awkwardness of carrying the handi-talkie, these men have devised this case along practical lines. The case adequately protects the handi-talkie, yet the radio can be carried easily and used without removing it from the case (fig. 1).

The case is constructed of very pliable leather (the first ones in R-4 were of elk and deer skins) and is lined with ¼-inch sponge rubber glued in place. The zipper permits the instrument to be readily put in or taken out of the case. The pocket on the back of the case provides space for one extra set of batteries. Back-pack straps permit the unit to be carried on a person's back in hiking or in rough climbing. The case itself, with an extra set of batteries, weighs 3 pounds 12 ounces.

The men using the unit appreciate the convenience and real time sav-

FIGURE 1.—Carrying case for handi-talkie is constructed of pliable leather lined with rubber and has back-pack straps for carrying. Radio can be used without removing it from case.

ing of not having to take the instrument from the case and find no difficulty in operating the transmitter. This is the way the unit is usually handled. Such a procedure is also a safeguard against laying the case down and losing it as so often happens when units must be removed from a case to be operated.

The first cases were constructed at a cost of $17.50 each. They have given excellent protection on the fire line and in storage and have proved adequate for shipping when properly tagged. During 1951 the cases with units inside have been accepted for commercial express and air shipment.

TESTING OUTFIT FOR UNLINED LINEN HOSE

L. E. Noel

Procurement Officer, Region 1, U. S. Forest Service

A unit for testing 1½-inch unlined linen fire hose returned from the field to the central fire cache has been developed at the Forest Service Warehouse in Spokane, Wash. This unit has been in operation now for over 2 years and has proved very satisfactory as well as saving a substantial amount of money. Prior to 1948, the testing of hose was contracted to commercial firms on the basis of low bid. The lowest bid received in 1948 was $2.65 per hundred feet. Net cost with the Forest Service unit has been $0.81 per hundred feet, and covers cleaning, testing, rerolling, and placing in storage. Total cost of the hose testing unit was $282 plus some salvage material.

The equipment and material necessary to set up the testing unit are as follows:

1 Water pump (same as used on Pacific Marine Type Y pumper).
1 Motor, electric, 3 hp., 1750 r.p.m.
1 Pressure manifold (4-inch pipe 48 inches long with plates welded over ends, and angle-iron legs approximately 32 inches high; eight 1½-inch pipe nipples welded to the pressure chamber, six on one side, approximately 8 inches apart, and two on the opposite side approximately 24 inches apart).
8 Gate valves, 1½-inch.
3 Pressure relief check valves, 1½-inch.
1 Pressure gauge (two gauges, of the same type, are preferred in order to maintain a continuous check on gauge accuracy).
1 Pressure relief valve, set to release at desired test pressure, and with ¾-inch pipe for returning overflow to water tank.
5 Table sections, each approximately 4 by 10 feet, with 4-inch sides, metal-lined, and equipped with saw-horse type legs.
1 Water tank, open top, approximately 24 by 60 inches, 24 inches deep.
3 Pieces suction hose, 1½-inch, each 8 feet long.

The one or two pressure gauges and the pressure relief valve, set to release at the desired test pressure, are mounted on the top of the test manifold, and the gate valves and pressure relief check valves are attached as shown in figure 1.

To set up unit for operation, line up table sections to form a drain trough approximately 4 feet wide by 50 feet long, with gradual slope toward water tank, which is at the lower end of the table in a position that will allow all water to return to it. Place the pressure chamber on the opposite side with the six gate valves extending over the tank far enough to allow them to drain into the tank. The end of the suction hose from the pump intake is placed in the water tank to supply the water used in testing the hose.

One section of suction hose supplies water from the pump through a gate valve to the pressure manifold. On the same side, the other gate valve with suction hose attached is used to return the water to the tank when actual testing is not in progress. This valve serves as a bypass and eliminates shutting off the motor while changing hose.

After the hose has been tested, it is drawn through a power wringer (fig. 2) located at the upper end of the testing table, and rolled on a reel located approximately 4 feet beyond the power wringer. Any reel of

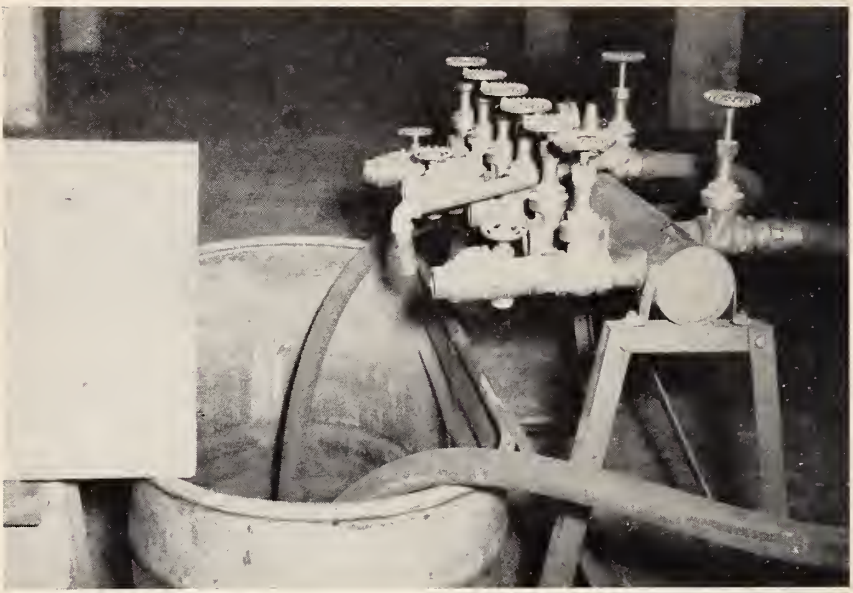

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FIGURE 1.—Pressure manifold of hose testing unit and its relation to water tank and table sections.

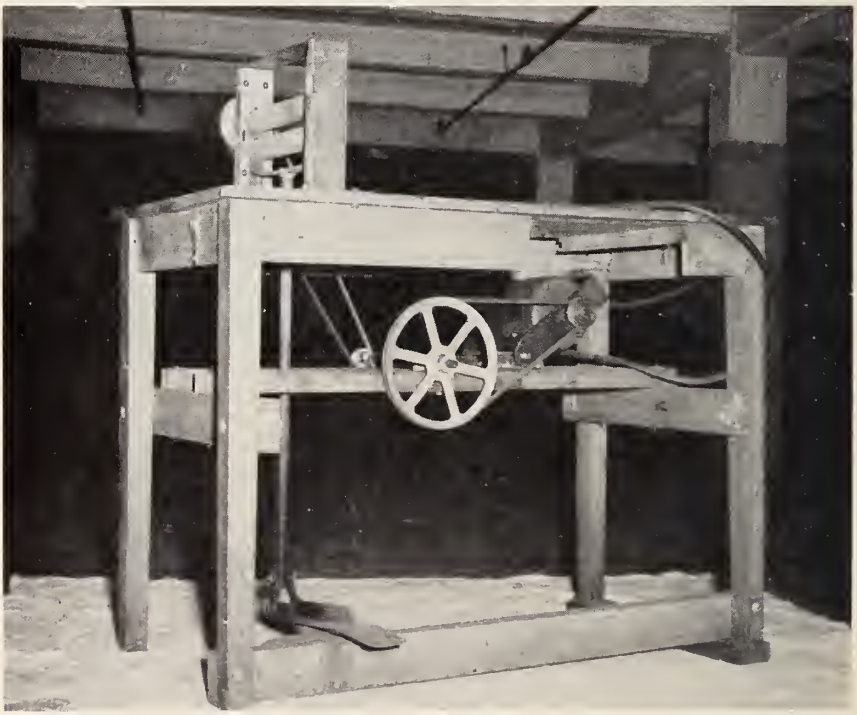

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FIGURE 2.—Power wringer which is part of hose testing outfit.

simple construction will suffice for rolling the hose. A very satisfactory type of reel was shown on page 31 of the October 1949 issue of Fire Control Notes. The hose can then be dried, bundled, and stored. It is not necessary to dry hose that has been properly treated to prevent mildew. Hose that has failed under test or has otherwise been found unsatisfactory is, of course, set aside for disposal.

Forest Service Continues Study of Power-Saw Fires

Early in 1950 the Forest Service initiated, in cooperation with State and private foresters, a study of forest fires caused by the operation of power saws. The initial phase of the study involves the compilation and analysis of information obtained from special reports on individual power-saw fires. Results of a preliminary analysis of information submitted for 1945-49 show Region 5 leading all others in number of fires as follows:

	Number of power-saw fires		
	National forests	*State protection area*	*Total*
Region:			
5	18	18	36
7	1	10	11
6	9	..	9
8	3	2	5
9	..	2	2
3	2	..	2
Total	33	32	65

Although there could be some difference in interpretation of causes, in general they line up as follows:

	Number of power-saw fires		
	National forests	*State protection area*	*Total*
Causes:			
Exhaust flame and backfire	16	7	23
Unknown	6	12	18
Spilled or leaked gasoline	7	5	12
Sawdust or forest fuel against hot muffler	3	3	6
Spark from saw chain	..	5	5
Short circuit on electric saw	1	..	1

The data were insufficient to give the number of fires by make and model of power saws.

The distribution of fires makes it obvious that the power-saw fire problem is Nation-wide. We are unable to estimate the number of power-saw fires that were unreported, but figures for 1950 and 1951 now being collected should be more complete. With full reporting on a Nation-wide basis we hope to be able to pinpoint the fire causing characteristics of power-saw designs, operating techniques, and other factors included in this problem.—Division of Fire Control, *Washington Office, U. S. Forest Service.*

FIRE CONTROL AND COOPERATION ON THE PEDLAR RANGER DISTRICT

B. A. Eger

District Ranger, George Washington National Forest

Although this article is confined to the Pedlar Ranger District the cooperation covered is similar to that which exists on all districts of the George Washington National Forest in Virginia.

For more than a decade a cooperative wildlife agreement has existed between the U. S. Forest Service and the Virginia Commission of Game and Inland Fisheries for the mutual management of game and fish activities on the Virginia National Forests. Mostly it has to do with environmental development and improvement for game cover, food, and protection. The work is paid for out of State funds obtained from the dollar stamp required by the State to hunt or fish on national-forest land, matched with Pittman-Robertson Federal funds prescribed by law. The work is planned and carried on by wildlife game managers and their laborers under the joint supervision of Virginia State game technicians and the national-forest district rangers, plus guidance from the Game Commission's staff and the forest supervisor's staff.

These wildlife project crews average a game manager and two laborers. Each ranger district has two or more of these crews. In addition, the State has a county game warden in each county and he in turn may have one or more deputies. To supplement the work of these men there are a number of State "roving" game and fish law enforcement officers.

Since there are three or four counties within the Pedlar Ranger District the Pittman-Robertson workers plus the State game law enforcement men make a sizeable and important part of the ranger's fire control organization. Most of the county game wardens are also appointed State forest fire wardens. Nearly all of them now have FM radios in their cars that hook up with their county sheriff's office and his police officers' cars. The sheriff's office ties into the Virginia State Police network by radio or teletype. The ranger's wildlife crews carry portable radios that can communicate with the national-forest fire towers and so in to the fire control dispatcher at the ranger's office.

All of this by prearranged cooperation and planning gives an efficient network of men over the ranger district for the dissemination of prevention education; enforcement of the State brush burning and forest fire laws; detecting, reporting, and investigating smokes; and in the case of larger fires and emergencies, taking part in the suppression and augmenting the communication system on and around the fire. The wildlife project crews carry a complement of fire suppression equipment and tools and have a definite part and responsibility in the ranger's fire control organization. All of these men are important in carrying fire prevention to hunters and fishermen when they are afield during the open season, which is usually at the time of high fire hazard.

Another cordial and cooperative situation also exists between the Virginia State Forest Service and the U. S. Forest Service. The areas of State and Federal responsibility in and around the ranger district are definitely agreed upon and shown on maps. However, the officers of both agencies work hand in hand in detecting, reporting and suppressing fires. The nearest and most available organized wardens and crews are dispatched to a fire and both agencies cooperate in suppression. If a fire is confined to the State area the State pays for suppression and makes its own report on the fire. If the fire is on the national-forest protective area or goes from State area to national forest, the George Washington pays for the suppression and makes the 929 report.

Most of the State county fire wardens have a pickup with pump, hose, and suppression tools. They also have radios that tie in with the sheriffs' offices and with each other. When necessary all of these facilities are pooled with the national-forest facilities for prevention, law enforcement, detection, and suppression. Many of the Virginia counties now have a county fire truck of the city type authorized and purchased by the County Board of Supervisors. While these fire trucks are primarily for burning buildings they go on call to all grass and woods fires that can be reached and they frequently suppress fires in their incipient stages. Some of these trucks are equipped with radio.

For its own organization the Pedlar District has a widespread system of national-forest wardens, about 30 crews with a mobilizing potential of 250 men. School boys in nearby high schools are organized and trained jointly by State and Federal forest officers. The colleges and military institutions adjacent to the district cooperate by furnishing manpower that is organized and trained by the district ranger. These forces are available to the State district foresters if needed. The fire departments of the towns and cities adjacent to the ranger district have organized and trained forest fire suppression crews and have frequently suppressed or assisted in suppressing fires in the fields and woods near their municipal boundaries.

Thus, the State Game and Fish Commission, the Virginia Forest Service, County Supervisors, State educational institutions, municipal agencies, and local citizens together with the U. S. Forest Service cooperate to organize and equip a fire control force to protect all woodlands and forests within their respective spheres of activity. As a result, the yearly average of fires is going down and the average area per fire is decreasing. Besides, such a coverage of equipment and men in the field has a salutary effect on potential risks. The National forest fire prevention campaign with State cooperation, press releases, and radio broadcasts has helped considerably in making the public more fire prevention conscious.

"PROTECTION TYPE" BASE MAP AND VISIBLE CARD DISPATCHING SYSTEM FOR FAST FIRE ACTION

Rivers R. Elliott
Assistant Supervisor, Area 8, Minnesota Forest Service

Since the beginning of forest fire control work the need for taking fast action has been prominently recognized. Swift action, as effective as possible with the equipment and personnel available, goes a long way toward favorable control action as a whole. Having the proper suppression force at the right location is equally important. The cooperative fire control and dispatching system here described and now in use in this area has been developed with these factors in mind.

The cooperative fire control organization is planned and projected by township subdivisions within the area and the various ranger districts. Township fire wardens, appointed jointly by the townships and the Division of Forestry, make up a majority of the cooperative personnel and, as a rule, are the keymen in getting direct cooperative fire action under way.

Keymen, other than township fire wardens, are appointed as special fire wardens in locations where cooperative personnel are desirable but not available through normal channels. Special fire wardens are quite often small-town businessmen or employees of industries, railroads, construction or logging companies. In all, 160 cooperating individuals are located in this forest protection area of 85 townships totaling 1,958,400 acres.

It is apparent that such an organization must necessarily be made up, for the most part, of untrained and semitrained people living in the territory to be served, and that certain understandable weaknesses may develop from time to time. In the operation of this dispatching system these probable weaknesses have been carefully considered and it is thought that selecting and dispatching alternate personnel will overcome certain obvious deficiencies such as current unavailability and emergency activities other than fire work.

The fire control and dispatching plan now in use in this area requires two basic units: the base map and the dispatching panel or board (fig. 1).

The base map is the standard ½-inch-per-mile type showing in considerable detail the roads, trails, and physical features of the area as well as the tower triangulation system. The headquarters map includes the entire territory under area fire control administration as well as boundary townships surrounding the area. Ranger district maps cover district units and boundary townships in adjoining districts and areas.

In addition to the standard map features listed this base map carries much of the special information upon which this fire control system functions. On it are shown the locations of the various cooperators. On it are also shown the three fire protection types now being used. These are symbolized on the map by the colors red, yellow, and white. Each color represents a distinct class of fire protection territory determined after combining and weighing all factors entering into the calculation of control probabilities for that particular type. These protection types have been determined by a detailed field survey and study covering the entire protection area.

FIGURE 1.—The complete base map and dispatching arrangement. All items are within easy reach.

Red indicates the areas where little or no settlement is present. The lands in this type are largely undeveloped, with few, if any, roads and little or no communication systems. The intermediate protection type is shown in yellow and includes areas of partially developed lands with scattered settlement and with some roads and limited communications. The white color indicates well developed agricultural lands with farm woodlots, good roads, and well established communication systems.

One of the fundamental values of the plan is its use as a guide in effective cooperative dispatching and control work in all three types.

The red type requires that immediate action be taken by a fully equipped suppression force of sufficient size to carry out complete anticipated control on the fire. The location of the fire in this type at once informs the dispatcher that no additional information will be forthcoming from the immediate vicinity of the fire prior to the arrival of the crew. Consequently, planning for complete control must be done at the outset. Dispatching procedure in this type is always direct and forceful. Cooperating personnel within an effective radius of the fire generally are used to supplement forestry overhead on the fire line.

The yellow type demands no less swift action than the red but the initial action may take a somewhat different course. Knowledge of the fire loca-

tion, terrain, and fuel types, together with known location and availability of local cooperators, sources of manpower and equipment, prevailing and anticipated weather conditions, as well as information obtained by telephone or relay, may convince the dispatcher that the initial attack can be successfully carried out without committing any appreciable amount of forest service equipment or overhead. Frequent progress reports from the fire line will keep him sufficiently informed to make any necessary alterations.

For the white type a different fire control action may be found desirable. However, the action is just as swift as in either of the two other categories. Action is begun immediately after receiving the report of a fire in this protection type. The extensive communication network in this type permits the dispatcher to check the exact location of the fire, determine its size, find out who, if anyone, is in attendance, the probability of the fire becoming uncontrollable, the location of the necessary labor and equipment supply, and the probable danger to farm, forest, or other property. The cooperator with whom the dispatcher first talks, usually being a resident of the community, will have sufficiently accurate information concerning the fire's probability as to enable the dispatcher and the cooperator to immediately make a control plan that will be effective with a minimum time lapse and with minimum commitment of regular personnel.

Forestry personnel and equipment are, of course, dispatched at once in all cases where there is any doubt regarding the possible effectiveness of the cooperative organization.

On the base map flat-headed pins bearing an index number show the location of cooperative fire wardens and keymen. Each number corresponds with one on the dispatching panel where the index is arranged by townships in each ranger district. A number is left blank in each township for any possible addition to the cooperative personnel. In so doing it is possible to keep the numbers consecutive for each township and district.

Map numbers do not change except as to location within the township. When a cooperator is dropped from the roster and another appointed, the latest appointee is assigned the number vacated. The numbered pin is then moved to the proper location. If a new appointment is not made the pin is removed from the map.

The area dispatching board is made up of a series of swinging panels, 13 by 34 inches and hinged as a unit to a common wall base. Each panel contains the complete fire dispatching plan for one ranger district and each district unit is essentially complete in itself. Fire dispatching data for the headquarters district are shown on the first panel.

Together the panels comprise the complete area cooperative fire dispatching plan. Under this panel unit system the fire dispatching plan of any ranger district is immediately available to the headquarters staff for use in district dispatching or for reference to cooperative action that may be taken.

Each ranger district panel contains two rows of standard 3- by 5-inch cards showing the location of personnel and equipment (fig. 2). Gummed card holder corners keep them in position. Allowing one card for each township the panel provides for information covering twenty townships. These cards are arranged by columns beginning in the upper left-hand corner with the southeast township of each district. However, any arrange-

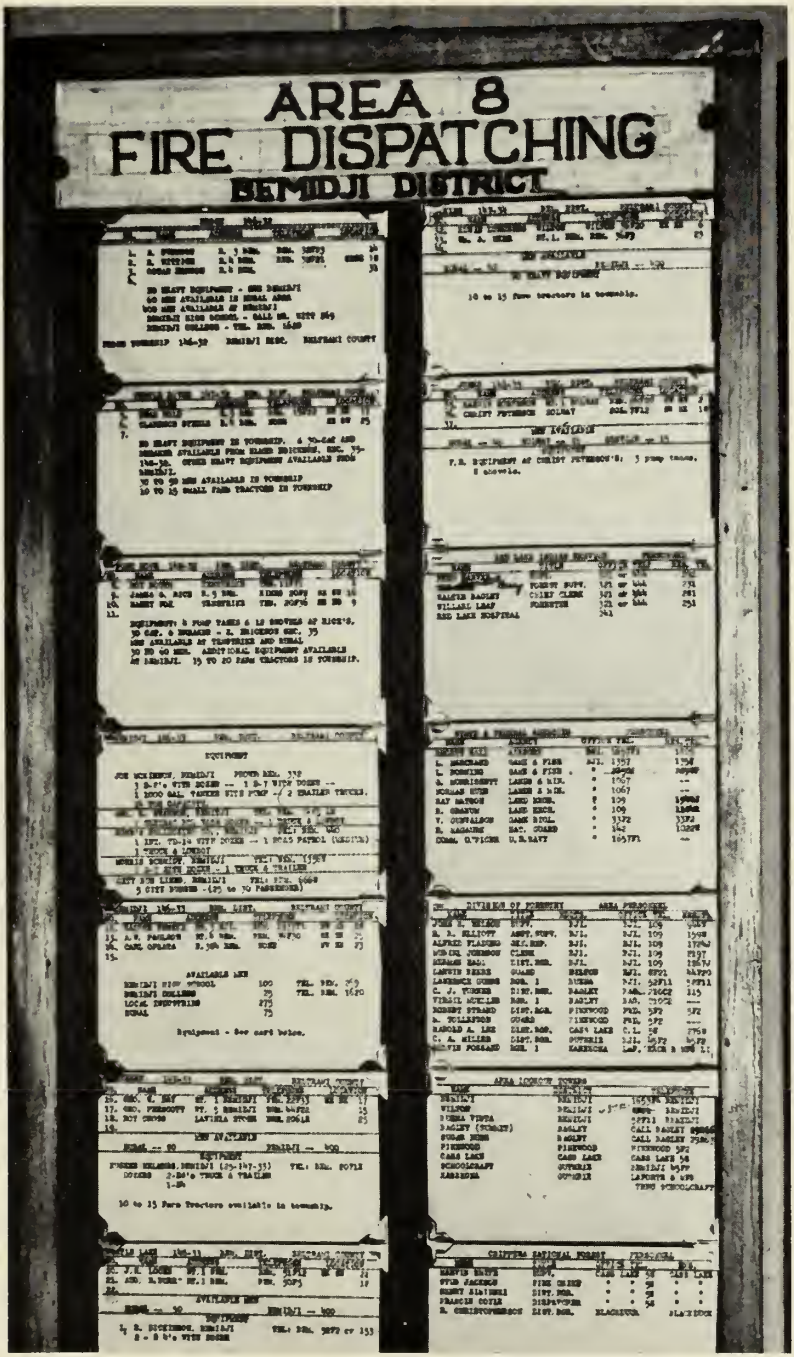

FIGURE 2.—A close-up of part of the first panel of the dispatching board showing arrangement of 3- by 5-inch cards in township sequence.

ment favored by the administrative control unit would work out satisfactorily.

Each card is designated at the top by the township name, township number, ranger district, and county. Cooperative personnel for the township are listed and each cooperator is assigned a number. The map pin with a corresponding number shows the correct location of the individual on the base map.

Each individual card entry shows name, address, telephone number, location of the cooperator and, if desired, the efficiency rating of the individual. Sources of fire fighting labor are shown directly below the personnel entries. Entries covering fire fighting manpower include city, county, and village sources as well as rural communities.

Equipment entries show location, size, and type of heavy and special equipment that may be obtainable for use on fires in the township or unit. A supplemental card showing heavy equipment location for the entire ranger district may be added if desirable.

It has been found that from ten to fifteen entries may be made on a standard 3- by 5-inch card without sacrificing either necessary information or completeness. In most cases a single card may easily carry all desired information pertaining to a township. However, the flexibility of the card arrangement permits additional cards to be inserted with no inconvenience and no interruption of township or unit sequence.

In townships having little or no personnel or equipment the card indicates that prevailing condition and refers the dispatcher to the first alternate location where desired equipment and manpower may be obtained. Special information may be indicated by special pins on the map and special numbers and entries on the dispatching panel.

In operation the complete system provides all basic fire dispatching information, literally at a glance. The entire ranger district fire control organization is spread out in front of the dispatcher, indexed and cataloged. The protection types are clearly indicated, the location of cooperative personnel is accurately shown, and equipment information is readily available. The immediate availability of these items of information, either singly or in combination, contribute greatly toward reaching the desired objective of speed and effectiveness in fire control.

Dispatching procedure, while triangulation reports are being received, is to determine, from the map, the protection type in which the fire is situated and the location of the nearest available cooperator. Reference to the dispatching panel at once gives the name and telephone number of the cooperator, the source of manpower and equipment, and any special information pertinent to the fire location. With this information at hand dispatching proceeds with a minimum of lost motion.

This dispatching and fire control plan has been gradually developed since 1942 when the first protection type base map was put into use by District Ranger C. A. Miller in the Schoolcraft District of this area. At that time it was used primarily as an aid in directing smokechasers and fire foremen in fire suppression work and as a guide for these temporary men in reaching logical conclusions on fire control work in the absence of supervisory forest service personnel.

Use of the complete plan for several seasons has brought about increased efficiency in cooperative fire action, which is, of course, reflected

in the over-all area control work. The plan is primarily a first-action one, but one that merges smoothly and effectively into the larger scale planning necessary on fires that do reach major proportions. Consequently, there is little of a spectacular nature in this dispatching method. It does, however, add considerably to the stability of the area personnel resource and tends to eliminate some of the uncertainties of this type of fire control planning.

Experience has proved that this type of planning and dispatching does, in many instances, reduce that vital time period between discovery and first attack, and at the same time permits the application of all area control power with a maximum of efficiency.

Corrosion in Carbon Tetrachloride Type Fire Extinguisher

A large agency of the Federal Government has recently had trouble with corrosion in carbon tetrachloride type fire extinguishers. This is the one-quart type of extinguisher most commonly known as "Pyrene," although there are several brands of the same type of extinguisher.

Laboratory tests were made of the fluid which the agency was using. A thorough inspection was also made of an extinguisher which had corroded badly. The laboratory reported that the fluid was in accordance with Federal specifications and was as satisfactory as carbon tetrachloride can be for extinguisher use. There are, however, two types of carbon tetrachloride under Federal specifications: Type I, regular uncolored; and Type II, colored. The coloring agent in Type II becomes gummy over a period of time and clogs the mechanism of the extinguisher and accelerates corrosion. The only reason offered for coloring the fluid is to avoid unauthorized use by employees in cleaning clothes, etc. The colored fluid will leave a ring or spot on fabric. As extinguishers are often used in homes, offices, and automobiles where cloth upholstery could be spoiled by using Type II colored fluid, Federal Supply Service will now stock only the Type I uncolored carbon tetrachloride.

Tests of this type of fire extinguisher and the fluid used in charging it reveal that with all the precautions it is possible to take, a good deal of corrosive action still occurs. The main points are summarized as follows:

1. Carbon tetrachloride is a powerful hygroscopic—it absorbs and concentrates moisture from the air.
2. Upon absorption of moisture, the formation of hydrochloric acid, a strong corrosive, begins in the liquid.
3. If this occurs in a can of fluid, the can will usually show evidence, and fluid should not be used from such rusty or corroded cans. If the action occurs in an extinguisher, it will gradually corrode to an unusable condition.

To avoid these troublesome and expensive failures, observe the following:

1. See that fluid containers are in good condition, not rusty or corroded. This usually indicates that contents are good.
2. Never use a part of the fluid from a can and reclose the can. There will be enough moisture in the air space to cause trouble. If you try to save part of a container, you will be pouring some acid into your extinguisher when you use the fluid at a later date.
3. Likewise, never leave an extinguisher partially empty. The air space is just as troublesome as it is in a can. Always refill the extinguisher at once, or empty completely and shake out any remaining drops of the fluid.—[From a U. S. General Services Administration memorandum] Region 4, *U. S. Forest Service.*

FIRE DISPATCHER'S MAP BOARD

ROBERT S. DIMMICK
District Ranger, Shawnee National Forest

The prototype of the dispatcher's map board described here was first put into use on the Jonesboro District of the Shawnee National Forest about 1937. It was recently modified to include features not found in the earlier model which contained only the map with azimuth circles and magnet-secured strings.

The map board measures 4 by 6 feet and consists of a wood frame faced with ½-inch plywood the front of which is covered with 22-gage galvanized iron (fig. 1). Upon this are mounted matched U.S.G.S. maps of the district. At each tower location a 3/16-inch hole is drilled through the

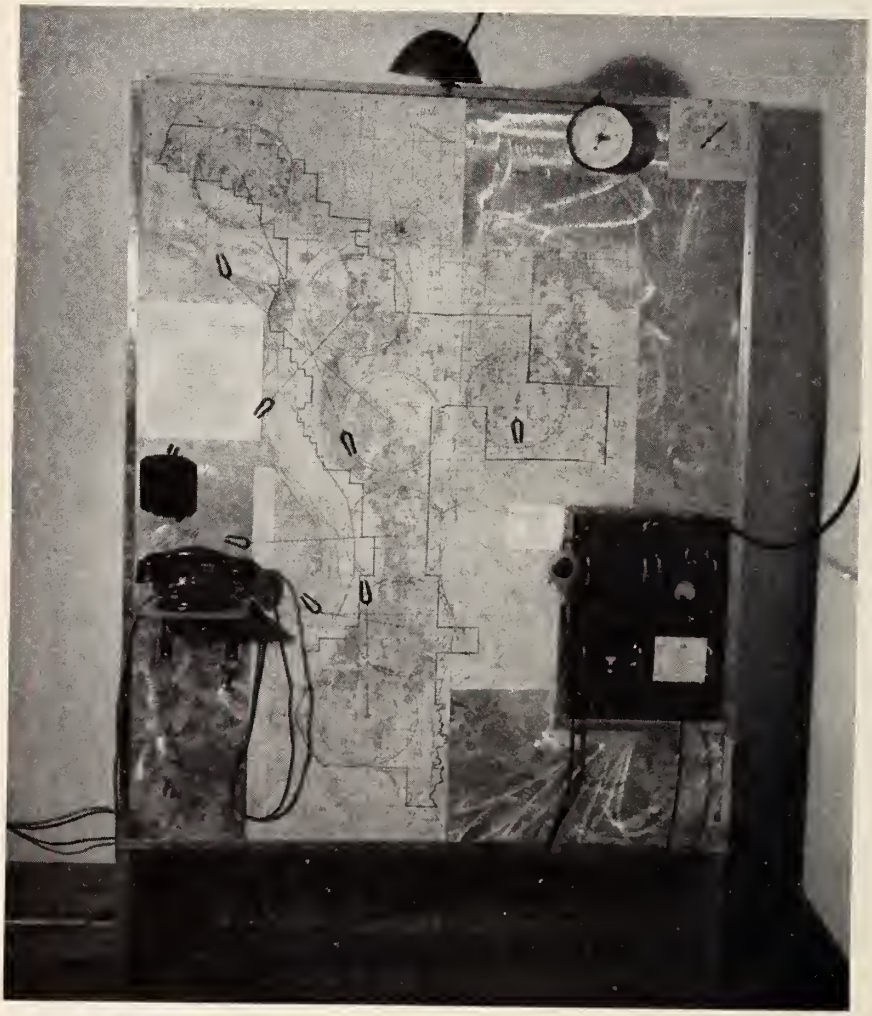

FIGURE 1.—Dispatcher's map board.

metal and plywood, and a metal grommet consisting of an ordinary screw-type binder post is inserted and secured. Azimuth readings are extended with 12-pound test, black nylon fishline held in place by small horseshoe magnets. The lines are retracted by metal weights. The weights should be less than the pull of the magnets, otherwise the magnets will not hold fast.

The map is attached to the metal surface with transfer varnish. Transparent 8-inch, "visitype" full-circle protractors are permanently affixed to the map at each tower location. The entire map surface is given two coats of varnish.

FIGURE 2.—Arrangement of dispatcher's work desk, map board, and accessory desk.

Various tools for dispatching have been installed in the map panel to provide both convenience and compactness. The anemometer buzzer, battery, and switch are located on the lower right side of the frame. Just above these and inserted in the panel is the radio. On the left and at the same height as the radio is the telephone, above which is a two-way key-type switch and a communication directory. The panel is lighted by a flexible-neck student lamp, with original base removed, mounted on the top of the frame. To the right of the lamp is a barometer.

The map board is located to the right of the clerk-dispatcher's work desk so that a 90-degree turn places the dispatcher in a convenient position from which to operate (fig. 2). Another 90-degree turn in the same direction places the dispatcher at a smaller desk upon which is kept the log and dispatching forms.

The arrangement has proved satisfactory at a station where the volume of fire dispatching is not great enough to justify a separate office. The panel not only provides convenience of operation to the clerk but also arouses considerable interest from the visiting public.

A PORTABLE VHF-FM RELAY ASSEMBLY FOR USE ON LARGE PROJECT FIRES

FRANCIS W. WOODS

Communications Officer, Region 4, U. S. Forest Service

Since the war, development of low-drain, dry-battery-powered, FM-VHF radio repeaters and their use in successfully extending the range of handi-talkie type field sets have exposed the need for a portable field repeater for use on large project fires. Several Forest Service regions have worked up satisfactory units. Mr. Woods' solution, as described below, employs a standard lookout repeater radio and battery combination that is commercially available and has proved quite satisfactory. In the near future we hope to have the Radio Laboratory study the portable repeater units of the various regions and by combining the best features of all come up with a suggested Forest Service standard for this type of service.—Washington Office, U. S. Forest Service.

For some time a need has been felt for a VHF-FM relay for large project fires to permit fire line communication reaching base camps or other points that are beyond point-to-point range.

The unit should have the following characteristics: (1) Be readily transportable by pack horse or car; (2) batteries arranged for polarized plugs; (3) control unit and repeater completely assembled; (4) antennas arranged for foolproof assembly and on masts which would permit installations in the same relative position to each other as to the relay and ground; (5) be pre-tuned and to stay in tune; (6) be readily assembled and put on the air by an inexperienced person.

A unit that meets these requirements was put together here last spring. A TF relay with its control unit was assembled in a wooden box 11½ by 28½ by 39 inches; the combined weight was 126 pounds (fig. 1). The

FIGURE 1.—Portable TF relay showing one antenna mast in place for operator. Battery boxes are on left.

two parts were completely wired and the control unit was arranged for easy disassembly. Wires for batteries were wired in place and brought out to two recessed polarized plugs.

The antennas were mounted in a wooden box 4½ by 9 by 72 inches, which weighed 45 pounds complete with all antenna materials (fig. 2). Standard TF battery boxes were used with the batteries assembled and the battery cable terminated in Jones plugs.

FIGURE 2.—VHF-FM antenna box used both for support for one antenna and shipping box for both antennas and guy ropes and tools.

Two antenna masts, one about 4 feet long and the other about 5½ feet long, were constructed from 2- by 2-inch stock. On one end of each mast a special antenna fitting built to our specifications was permanently mounted. One-quarter wave rods can be screwed into the fittings.

The short mast is painted green as is the relay housing. The long mast is painted orange as is the box which houses the antenna mast, rods, tools and rope for transportation. The relay housing provides a support for the green antenna mast. The antenna shipping box is the support for

the orange antenna mast. Fifty-ohm coax cable is permanently attached to both antenna fittings. One piece of this cable on the green mast is just long enough to reach to a recessed antenna fitting on the top of the relay housing. The orange mast has a 15-foot piece of RG8U for attachment to the other antenna connector on top of the relay housing. The short piece of cable will reach to only one of the antenna fittings, thereby providing a foolproof way to attach the proper antenna fitting to the proper antenna.

The whips are hollow and the tips are adjustable. Two whips are painted green and two are painted orange. Each has a lug soldered so that the tip can be inserted only up to the proper point. This provides an easy way of making sure that the antennas are the right length for the frequencies being used. The green tipped whips are screwed to the green antenna mast; The orange tips, to the orange antenna mast.

Tests indicate that the unit can be set up, tuned, taken down, and reset at another location without serious detuning. The unit illustrated was used once last season and was found to be satisfactory.

The following instructions are attached to the relay housing and have proved adequate and simple enough for use by inexperienced personnel.

INSTALLATION AND OPERATION INSTRUCTIONS FOR THE R-4 REGIONAL OFFICE VERY HIGH FREQUENCY FM AUTOMATIC RELAYS

This unit consists of four packages, the largest containing the radio relay unit itself and its control panel.

The long, slender package contains the antennas and connecting cables, and short supporting masts for the antennas.

The other two packages contain the batteries which furnish power for the unit.

All of this equipment should be handled with care and packed carefully to avoid damage.

Upon arrival at the location chosen for the installation of the radio equipment, unpack the equipment from the conveyance in which it was brought.

Set the relay cabinet on a good solid foundation.

If there is danger of the unit being knocked over or broken, support it with rocks, logs, or ropes so that it cannot be upset.

Open the antenna box. Take out all the material. Assemble the whips by colors, putting the orange tips to the orange bases, and the green tips to the green bases.

Insert the tips into the long rods as far as they will go. Tighten the rods in place with a screwdriver in the box. Don't tighten too much or you will break the head off the screw.

Assemble two orange-tipped whips to the orange-colored antenna bases. Use both wrenches, making sure the fitting attached to the antenna base *is not moved* —this is very important. Attach the two green whips to the green antenna bases.

You now have assembled two antennas, one green and one orange. Place the orange antenna box about 15 feet away from the relay box. Place it upright, making certain that the square hole in the end of the antenna box is up. Tie the antenna box so that it cannot fall down. Place the orange antenna mast with the orange whips attached through the hole in the top of the antenna box. Fit the base of the orange mast firmly in the receptacle in the box. Attach the green antenna mast to the antenna relay box in the same manner.

Attach the fittings on the end of the antenna cable to the fittings on top of the relay box. Attach the short cable to the fitting closest to the green mast. The antennas are now ready for service.

Hook the screen door catch on the antenna feeder to the eye on the green mast. Place the two battery boxes adjacent to the left end of the relay housing. Open the battery boxes and make certain that all plugs are in place, and that the connections between the dry cells are tight and unbroken.

In the event that the battery compartments contain two large, black batteries, remove the battery caps, take a pocket knife or some other sharp instrument, very *carefully* cut out the inner seal, which will be found directly below the battery caps.

It will not hurt if the seal material falls into the battery. Very carefully fill both batteries with ordinary water. Fill them right up to the top of the filler plug. Be careful not to let any water splash out of the battery. If it does, remove it immediately with a handkerchief or some other absorbent material. Replace the battery caps.

Remove the plastic seal and the red guard on the top of the batteries—*this is important.* Take the battery cords out of the battery boxes, close the box lids and insert the battery cables in the appropriate jacks on the end of the relay housing, being careful not to short the plugs.

Open both lids on the relay housing. On the top of the relay unit in the bottom compartment will be found a toggle switch (SPKR handset on). Make certain that this toggle switch is in the "up" position. Find the "on" and "off" buttons on the control units. Then depress the "on" button and hold it momentarily—release it. Turn the black knob to the Squelch Disable position. With the volume control vertical, a rushing noise should be heard from the loudspeaker indicating that the receiver is operating normally.

Place the transchannel switch to position number two. The black knob on top of the relay unit in the bottom compartment should be placed to the *final plate* position. Check this—then push the transtest button, which is adjacent to the final plate knob. The meter on the right-hand side should rise to 9, approximately, on the scale, indicating that the transmitter is operating normally. Release the transtest button. Push the toggle switch on the meter panel down to *unattended repeater.* Place the black knob on the control unit in the upper compartment to AUTOMATIC REPEAT. THIS IS EXTREMELY IMPORTANT. IF YOU FAIL TO DO THIS, THE UNIT WILL NOT RELAY PROPERLY. Close and lock the compartment doors. The unit is now ready for service.

Generator Unit as a Training Aid

Many times it is not possible to choose the best location for a fire personnel training school and still show the training movies because of the absence of power to run the projector. A small portable AC, 2-KW, 115-V generator and gasoline motor will provide power for the movie projector. A unit weighing about 175 pounds was available in 1951 for approximately $225.

This unit has many uses other than just running a movie projector—it can furnish power for a saw, tool grinder, floor sander, lights for a fire camp, etc. It will greatly reduce many construction and maintenance costs at outlying stations in addition to its uses in forest fire prevention, presuppression, and suppression work.

The most desirable type is one with the generator and motor separate. It can then be mounted on a light metal platform and the generator can quickly be detached. Thus, the motor and the generator could easily be packed on a pack animal for transportation to areas inaccessible to motor vehicle travel.—V. A. Greco, *Forester, Gila National Forest.*

Ash Trays on Saddles

On Pine River of the San Juan National Forest in Colorado, Mr. Bob Venuti, wrangler of a select dude ranch requires each rider when he goes on a pack trip to put his cigarette and cigar butts or pipe coals in a tin beer can attached to the saddle horn. The proprietor of the dude ranch saves the beer cans, which have two openings punched in the top, fills them about half full of water and then attaches them to saddle horns. Besides providing a safe container the stunt impresses riders with the need and importance of preventing fires and being careful with smoking material.

THE PINON-JUNIPER FUEL TYPE CAN REALLY BURN

DWIGHT A. HESTER

District Ranger, Grand Mesa National Forest

In the Rocky Mountain Region, we are rapidly losing any illusions that any of our fuel types are of the "asbestos" variety. Aspen used to be considered fairly fireproof until certain crown fires, gathering speed in adjacent conifer stands, rolled through without loss of momentum. The moist, high-altitude spruce type has been even more deceptive on disastrous occasions. But at the lower elevation, in the southwestern part of the region, is the familiar pinon-juniper type, and this never gave any trouble. Most of it is outside the national-forest boundaries, and it is usually grazed so heavily that all fuel is gone except the trees themselves (fig. 1). The records show that our neighbor to the south, the Mesa Verde National Park, had a big fire in such a type in the drought-ridden thirties, but that seemed to be a "one in a million" occurrence.

FIGURE 1.—Typical pinon-juniper type, showing scattered stand, sparse vegetation, and intermingled areas of bare ground.

Then, in 1950, we suddenly found out that under extreme conditions the fuel-sparse pinon-juniper type will not only burn, but will literally explode. Since this type is widespread through the Southwest, perhaps other fire control personnel could profit by our experience.

During the early part of June 1950, the weather was fair and dry in western Colorado. Land managers were not concerned since there had been normal snowfall during the winter, and the early spring had been cold, if dry. The spruce type well above the pinon-juniper still held considerable snow. By June 10 the weather had turned warm, and strong winds came up with regularity during the afternoons. Relative humidity was down to 7 percent. It was during this period that a coal mine, abandoned and burning deep underground for some 20 years, chose to explode. This explosion, according to an eyewitness, occurred at 3:10 p. m., and the fire seemed to be in the crowns at once. By 5 p. m. the fire had traveled about a mile "on the back of a strong wind" and showed no signs of abating (fig. 2).

FIGURE 2.—The fire as seen from a point 15 miles away, 2 hours after origin.

We soon learned that natural barriers, such as ridges, cliffs, and roads, were of no value in heading off this type of fire. The country was too broken and rocky for bulldozers to be used effectively. The shaggy bark of the juniper made fire brands to Satan's liking. Flaming strips of this bark, often 2 feet or more in length, were hurled ahead to wrap themselves around other trees which caught fire with a roar and gave off ropelike strips of bark to repeat the process. Distance between trees and width of natural barriers seemed to have little influence on this type of spread. In one instance, a cleared, 40-foot fire lane was crossed its entire length by the fire without detectable hesitation. Backfiring was not practicable since the only fuel was standing trees which had to be crowned out to burn, and a crowning juniper in a high wind is not to be fooled with.

Not only can the fire explode during the afternoon, it can continue this blowup well into the night.

On our fire, the expected evening wind shift did not take place until about 8 p. m. This occurred as a 90-degree change of direction (a down-mountain draft) with no appreciable change in wind velocity, and the fire really rolled downhill. The rapid rate of spread continued until 11 p. m., at which time the wind velocity fell from an estimated 20 to 30 miles per hour to a gentle breeze.

Judging from the behavior of our fire, I believe that the head of such a fire should not be attacked until the crowning stops, unless there are means available for creating extremely wide barriers. Once the fire is out of the crowns, men can work relatively close to the fire and can work in most of the burn within 2 hours. I believe the best bet is to fell a swath of burning trees at least 100 yards wide, working from the edge toward the interior of the burn. One power saw per 4-man crew seems to be the answer for this work. In this short-tree type 2 men can operate the saw with a reasonable degree of safety, and the other 2 haul away the felled debris. Mop-up usually has to be done with little or no water since much of this type is without "living" water of any kind.

One cannot count on the oak brush above the pinon-juniper type to serve as a buffer. On our fire, the oak brush, although only about one-half leafed out, burned readily and crowned out in most places. As was found in Maine in 1947, hardwoods are not immune to crowning.

Although the bulk of the trees remain standing after the fire, the heat is quite intense and leaves the ground well cooked (fig. 3). Regrowth of

FIGURE 3.—The intensity of the fire denudes the soil to a point where watershed damage of long duration will result. Ditch and gully in foreground were cut before the area burned.

any kind is bound to be slow and erosion will be a problem. On the fire described, the wind started drifting the soil before the fire was out and continued throughout the summer. Only two rainstorms of relatively light intensity occurred during the summer, but small gullies were in evidence by fall.

While our pinon-juniper type can hardly be classified as a high fire risk, it is not fireproof. When conditions are right, it can be quite explosive, resulting in fires that are difficult to control. A burn in this type will be slow to heal and can result in a long-term watershed problem.

Sodium Bicarbonate as a Fire Extinguisher

Ed Melton, former Forest Service pumper crewman, writes us from Fort Ord, Calif., as follows:

"Enclosed with this letter is a 'trick of the trade' that we used when I worked for the F. S. in southern California. We had occasion to use this device several times on vehicle fires, and it never let us down.

"The idea was given me by a lieutenant in the Berkeley, Calif., Fire Department. He had only the highest praise for it.

"The various fire type classifications in the article are standard Underwriters' Laboratories classifications.

"If you care to publish this idea in FCN, it might prove as helpful for others as it was for us, because the fire-extinguishing qualities of common sodium bicarbonate are relatively unknown."

A lot of pumper crews would like to have carbon dioxide or dry chemical extinguishers on their rigs, but cannot do so because the cost of these units is beyond the funds available. However, there is available a good substitute which is simple and inexpensive, and which has been in use for some time: it consists of two or more 5-pound, sealed, paper sacks of ordinary bicarbonate of soda, double-bagged. Sodium bicarbonate is one of the basic ingredients of dry chemical extinguishers, and obtains its extinguishing action primarily by releasing carbon dixoide gas when it comes in contact with burning material.

This chemical is very effective against chimney fires, greasy restaurant kitchen exhaust vent fires, and any class B fire (gasoline, oil, grease). Because sodium bicarbonate is a nonconductor, it is safe to use against class C fires (power-on electrical). As this chemical extinguishes only by smothering, and with no cooling effects, it is not too effective against class A fires (wood, paper) and when using it, caution must be taken to prevent a possible flash-back.

To use the sodium bicarbonate against a chimney fire, open one sack and pour the contents down the chimney. If the fire is so intense that this does not extinguish it, then drop the other bag, still sealed, down the stack. It will burst when it hits bottom, and the draft will suck the chemical up the chimney, usually producing the desired results.

On class B fires, the extinguishing action is obtained by throwing the chemical on the burning surface, starting with the nearest edge of the fire and working back and forth away from you. A small scoop will greatly facilitate spreading.

It is necessary to keep the sacked bicarbonate in a dry place, or it will cake up. Another disadvantage is the same as with the old sand-and-scoop extinguisher: it is difficult to spread the chemical evenly and quickly, and to obtain any appreciable range by hand spreading.

Of course, this method is only a makeshift. If it's at all possible, get a CO_2 or dry chemical extinguisher. If such units cannot be had, then a couple of 5-pound sacks of bicarbonate will offer the next best solution.

To become acquainted with the way sodium bicarbonate operates, try some of it on several oil or kerosene test fires; the results might be found to be very interesting.

For any forestry pumper that operates in a section where there are summer homes, a resort area, or a large volume of motor vehicle traffic, here is an idea that might be well worth considering.

HORSE-PACK PUMP

Cleo J. Anderson

District Ranger, Tonto National Forest

In this dehydrated Southwestern Region many of the numerous lightning fires occur in very inaccessible areas. Most of these fires are readily controlled but mop-up is very slow because no water is available. The need for getting a small amount of water to such fires to facilitate mop-up has long been recognized.

This need has in a measure been met by using two water pack cans with ¾-inch hose bibs, 25 feet of lightweight garden hose, and the "trombone" pump from an ordinary back-pack pump (fig. 1). The garden hose

Figure 1.—Water pack cans in place with hose and pump ready for use.

connections make it possible to change the hose from one pack can to the other and to detach the pump so that the cans with hose can be used to supply other back-pack pumps. Thus 20 gallons of water per horse can be taken into fires in very rough country where if frugally used it will go a long way toward speeding up mop-up work. The hose is attached to the horse's halter so the pump operator can lead the horse coincident with operating the pump.

This same unit also proved invaluable as a means of packing water into back-country fire camps. This means of transporting and using water on back-country fires may be applicable elsewhere in the country.

FIRE CAMP AIDS AND SUGGESTIONS

Charles D. Sutton

General Foreman, Lincoln National Forest

Under the most satisfactory conditions the average fire camp is not too convenient and equipment and facilities are limited. Over a period of years a review of camp conditions and operations after each project fire has resulted in certain improvements to facilitate fire camp operation.

Serving tables suitable for one or two mess lines were a problem as they were normally nailed together out of precut lumber when camp was set up. These tables were not very satisfactory because they were not rigid, were hard to level on uneven or rocky locations, and were impossible to keep clean. This trouble has been corrected by providing each fire camp outfit with two tables 8 feet long, 18 inches wide and 34 inches high with folding metal legs. The tops are of ¾-inch plywood with a ¾- by 2½-inch rail securely fastened with screws to the underside to prevent sagging and to make the table rigid. The legs are made of ½-inch square or round steel hinged to underside of table and are held in place by two diagonal braces of the same material hinged to center of underside of table. The cross braces between the bottom of the legs are in two pieces with a hole in the ends where they lap in the center. This permits spreading the legs at the bottom and they are held in place by a pin that also holds the diagonal brace in place. The legs are pressed into the ground to level the tables and make it more rigid.

Elevator bolts with the flat heads pulled down flush with the top of the tables are used to fasten hinges for legs and diagonal braces to the top. The tables have been given three coats of good grade red enamel and then varnished. This provides a smooth top that is easily washed with soap and water after each meal and there are no cracks to gather grease and particles of food. At the end of each fire season the table tops are sanded lightly and given another coat of varnish, and after several years of use they are practically as good as new. The legs and diagonal braces fold inside the 2½-inch rail on the underside and the two tables are placed with tops together and held by straps making a light compact bundle that is easily loaded and transported to the fire camp.

The same conditions and problems existed with the knock-down tables used in the camp kitchen by the cooks for preparing food and making lunches. Tables 4 feet square and 3 feet high were made for the kitchen, using materials and design similar to those for the serving tables. For preparing meats or slicing vegetables, two 2-foot lengths of 2- by 12-inch unpainted lumber are sent out with each cook table. These boards and the tables are easily cleaned and as the boards become rough or cut up, they are replaced.

Tables of the same general type and design were made for the time keepers and tool checkers. These tables are 4 by 2 feet and 32 inches high with two small drawers in them (fig. 1). Two light folding steel chairs are packed with each table and it is possible to seat two timekeepers at a table and check two lines at the same time. The drawers provide space for extra time slips, pencils, schedules, etc., which eliminates going to the timekeeper's or tool checker's kit for supplies while checking men in and out.

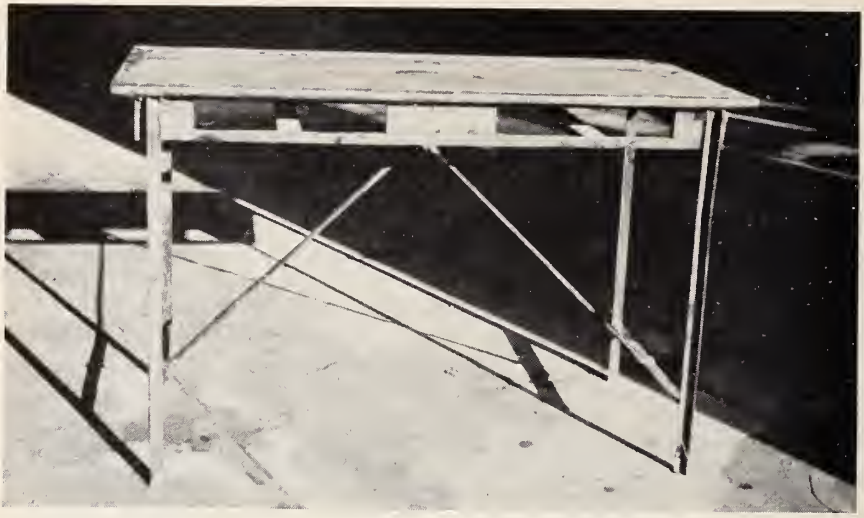

FIGURE 1.—Timekeeper table with drawers removed.

All of the tables are light, rigid, and durable and fold into a compact bundle. With normal maintenance each season they will last indefinitely.

Another problem that consumed much time and often wasted food was slicing bacon, various other cooked meats, and lunch meat and cheese. This was solved easily by purchasing a lightweight hand-operated slicing machine. It was estimated that this machine more than paid for itself on the first fire as 30 percent more sandwiches were prepared from the same number of pounds of lunch meat and cheese that was formerly sliced with a knife. It was much faster: one or two men with the machine could slice as much meat, etc., as four or five with butcher knives. With the bone removed, roasted meat and boiled or baked hams were also sliced by machine, saving much time and providing more uniform servings. The machine was also used for shredding lettuce for salad or sandwiches and cabbage for cole slaw. The slicer saved so much time and food that it is now considered indispensable in a fire camp on this Forest.

Water has always been a problem in fire camps in this dry country. It is often necessary to set up in an undesirable location because that was the only place water was available. This was corrected by using a lightweight, trailer-mounted, 250-gallon water tank. The trailer has a tee on the back end with two ¾-inch molasses stop type faucets that make it convenient for filling canteens and drawing water in vessels for the kitchen. The capacity of the tank and quantity of material necessary to properly chlorinate it is posted on the end of the tank and it is treated each time it is filled, thus providing safe drinking water.

A portable light plant mounted on a trailer has been used for several years in fire camps (fig. 2) and it was found that a few large bulbs are superior to a number of smaller ones. Two of the 100-foot cables were fitted with mogul sockets and 1000-watt bulbs. One of these lights properly suspended over the kitchen and another over the tool checking area, lights

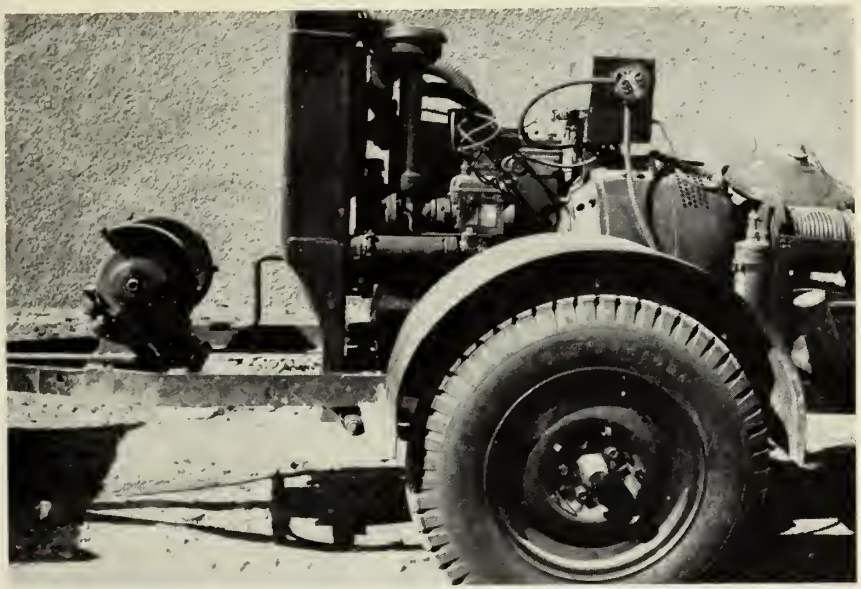

FIGURE 2.—Portable light plant.

the area much more satisfactorily than was ever done with a number of cables, extension cords, and smaller globes.

The equipment and suggestions listed above are simple and inexpensive but have proved their worth in time, labor, and food saved and have added materially to the efficiency of fire camp operations.

Smokey Bear Prevents Disastrous Forest Fire

The story of how Smokey Bear actually prevented a forest fire was told by Ranger "Dutch" Sullaway to the Mt. Shasta Herald, a northern California newspaper.

A party of campers stopped in the small mountain town of McCloud, Calif., after having abandoned their camp. Upon viewing a poster of Smokey Bear carrying a fawn out of a blazing forest fire, one camper turned to the other and said, "Are you sure we put out our campfire?" The other camper was not too sure, so together they went back to where they had been camping.

Sure enough, there were still hot coals and already the fire had crept away and was burning in thick pine duff. The campers extinguished the fire and Ranger Sullaway gave Smokey Bear credit, as did the campers, for preventing a forest fire that had real possibilities of becoming a costly disaster.—From Mt. Shasta Herald. Mt. Shasta, Calif.

HOG RINGS SIMPLIFY CARE OF KAPOK SLEEPING BAGS

R. Boyd Leonard
Fire Control Officer, Salmon National Forest

The annual job of cleaning kapok sleeping bags after a busy fire season is one requiring many man-days of labor. Any method used to reduce time of tearing the beds apart, cleaning, disinfecting, putting back together, and rerolling is generally well worth investigation, since a few minutes saved on each bed adds up to hours when applied to the whole job. Each improvement continues year after year and in time represents a real saving of time and money.

The idea of using hog rings occurred several years ago and was put into practice on the Salmon National Forest.

A commercial tool for clamping the rings in place worked satisfactorily (fig. 1). However, there was no tool available for removing the hog rings when the beds had to be taken apart for cleaning.

Figure 1.—Inserting a hog ring through the eyes placed in the separate parts of a kapok sleeping bag. When in place all parts are fastened securely together with the closed ring.

The tang end of two files or in some cases two pairs of pliers were used originally to force the hog rings open. This proved to be a tedious way of removing the rings and led Kenneth Call, fire dispatcher, Salmon National Forest, to devise a tool that greatly simplified this operation.

The tool is made from two pieces of strap iron ¼ by ¾ by 9 inches. These are shaped to a point on one end and into handles on the other (fig. 2). The handle ends are then wrapped with leather or tape. A short iron stopper is welded to the pointed end about half way from the points to the fulcrum to prevent the points from passing by one another. This makes it easy to get both points into the hog ring at the same time. The sharp points on the tool are dubbed off just enough to prevent them from becoming a safety hazard.

FIGURE 2.—Hog ring spreading tool showing its size and how it operates to spread a hog ring.

The new tool reduced the time required for this one operation to one-half to one-third that formerly needed. It also reduced the possibility of a man jabbing his hand with the end of a file or getting stuck with the sharp ends of the hog ring. The safety aspect alone made the tool well worth while. The first tool proved a success and as a result several have been made with minor improvements over the first model.

To finish the bed cleaning operation the beds are rerolled and a name tag is fixed on with a hog ring. The purpose of the tag is to make it possible for a man to get the same bedroll when for one reason or another the beds are stacked or transported.

A Low Cost Rust Preventive for Fire Tools

A commercial product called "Utility Coating" is available for use in preventing rust and corrosion on metal.

The Toiyabe National Forest has been using this product for several years and has found it superior in many ways to the common practice of oiling shovels, pulaski tools, and axes to prevent rust and corrosion while in storage. It does not wash or rub off and produces a dry hard coating which does not gather dust. The coating can be applied either by dipping the part of the tool to be treated or with a paint brush.

Utility Coating comes in 5-gallon pails and retails at about 15 cents per gallon. For best results it should be put on tools mixed with paint thinner or gasoline using five parts of gasoline to one of Utility Coating. For further information write to Regional Forester, U. S. Forest Service, Ogden, Utah.

SAFETY CHAIN AND LINK

Lester K. Gardner

Administrative Assistant, Division of Engineering, Region 5, U. S. Forest Service

Last fall on a fire, one of our mechanics was injured while inflating a tire which had just been mounted on a large truck wheel. Before the tire reached maximum inflation, the rim lock ring dislodged, allowing lock ring and tire to fly apart from the wheel. The lock ring struck the mechanic's right hand and the tire struck him on the side of the face. The accident occurred even though the lock ring had apparently been properly positioned before he started to inflate the tire.

The safety device illustrated in figure 1 was developed by Frank H. Little, chief foreman of the Redding Equipment Depot, Redding, Calif., to prevent reoccurrence of a similar accident. Used in pairs, the safety chains are adjustable to fit all types and sizes of wheels and tires where complete encirclement of the tire and rim is possible. It is not necessary, of course, to use safety chains on the one-piece drop center rims commonly used on light vehicles.

Cost of the model shown in the accompanying drawing was $1.81, or $3.62 per set. A set of chains fits compactly into a small space and may readily be carried in field mechanic's truck, luber units, etc., or used directly in the shops.

Procedure for use of the safety chains is as follows:

1. Assemble tire and lock ring on rim.
2. Encircle tire and rim with safety chains placed opposite each other. When split lock ring is used, quarter the chains away from the split ring ends.
3. Place the chains through the holding links and pull through.
4. Slip the nearest chain link into holding link slot. Allow some slack to prevent chain becoming tight when tire is fully inflated.
5. Inflate tire.
6. Determine that rim lock ring is properly seated, then unhook and remove safety chains.

Application for patent is pending. However, the safety chain and link may be used by the Forest Service and other government agencies which may choose to do so.

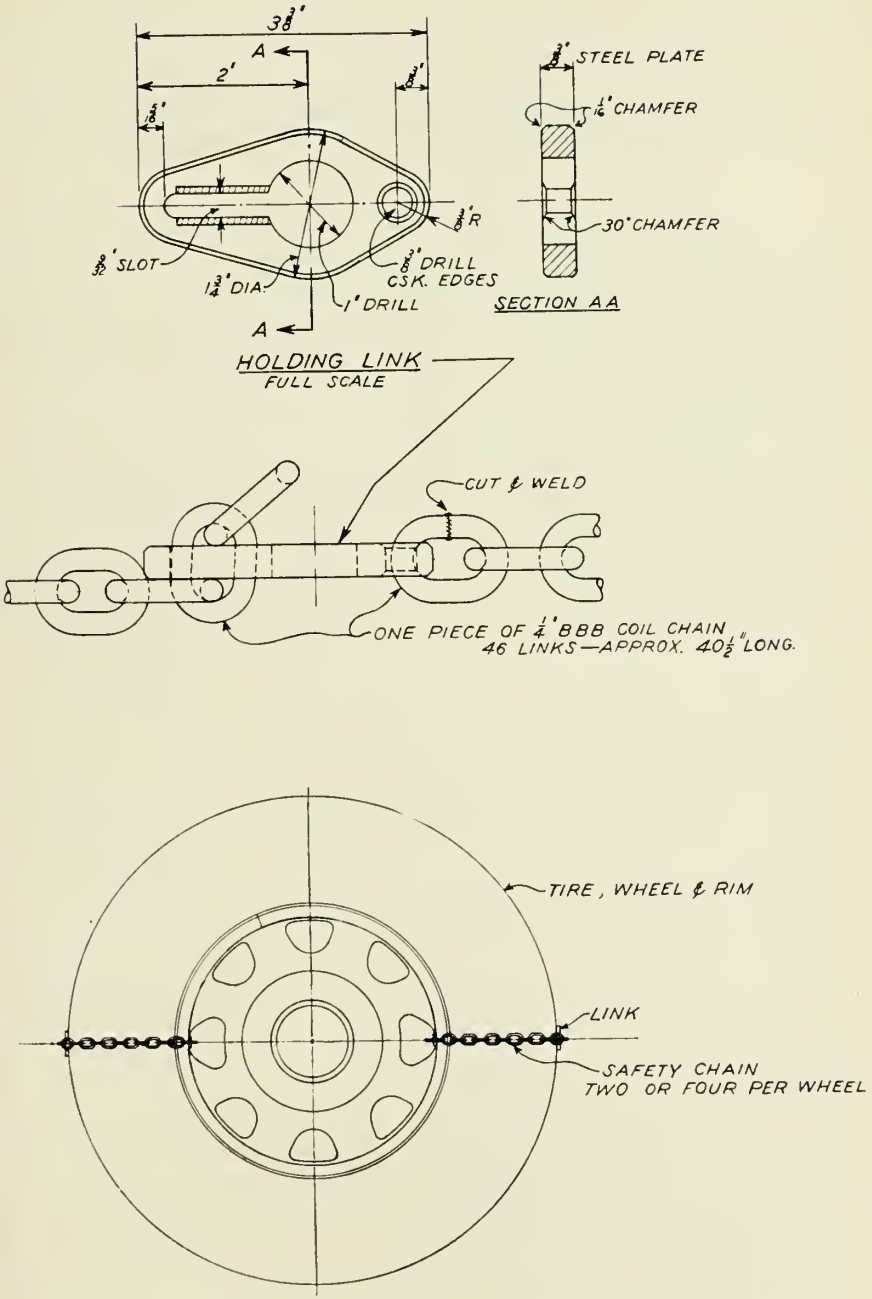

FIGURE 1.—Safety chain and link for use on lock ring type wheels and rims.

U. S. FOREST SERVICE VIEWS FIRE PROTECTION PLANS FOR LOGGING OPERATIONS [1]

A. E. Spaulding

Assistant Regional Forester, Division of Fire Control, Region 1, U. S. Forest Service

Fire protection on logging operations is everyone's business, and especially that of the operator. He has the most to lose; but the industrial worker, banker, storekeeper, farmer, fisherman, hunter, home builder, and you and I also have an interest in the values that might be destroyed.

Fires in going logging operations may cause staggering losses counted in tens or even hundreds of thousands of dollars. You all know how expensive logging equipment is these days. When it is destroyed by fire, the dollars add up fast. Felled timber, logs, and cold decks are particularly vulnerable in case of fire. Under today's costs and values they pyramid the losses fast when they go up in smoke.

In addition there are logging improvements that may be destroyed, and fires that start in logging operations can and do spread to standing timber and reproduction. Neighboring operations and lands may also be damaged.

Watershed, recreation, and similar values may be seriously affected. The interruption of the woods operation may cause the closing of dependent sawmills or other plants. All such losses have a chain reaction that can affect many people today, tomorrow, and far into the future.

The direct losses of the logging operation may be small in comparison to the increasing losses suffered elsewhere, indirect losses in the economic structure dependent upon healthy logging operations. All such losses are bad enough in peace time, but under the present international situation, they become intolerable. Therefore, fire protection on operating areas is critically important to logging operators and fire control people.

We all recognize that the cutting of green timber usually increases the fire hazard. Green fuel turns to dry fuel; the forest canopy is open and ground fuels are dried by sun and wind. Logging tends to stir up the fuels and concentrate them. The risk of fires starting is increased by the numbers of men in the woods and also by the presence of various types of mechanical equipment such as tractors, trucks, and skidders.

Compensating to some extent for the increased risk are the woods crews, if they are properly equipped for fire fighting, and the logging roads which permit quick attack and may also be used as ready-built fire lines.

Regardless of responsibility for fire control on logging areas, the operator is in the best position to take prompt action. He has men and equipment on the ground, and has, as a minimum, a moral responsibility for quick and effective suppression action on all fires starting close to his operation. He is also in the most favorable position to provide some of the needed supplemental fire protection.

[1] This article is from a paper presented by the author at the 41st Annual Conference of the Western Forestry and Conservation Association.

Nevertheless, advance planning is necessary to make the best use of the facilities of both the operator and the protection agency. This plan should give consideration to prevention, preparedness, and hazard reduction, which are discussed here, and suppression.

Fire prevention should be designed to prevent fires starting from the logging operation, and desirable measures must vary according to local conditions. Yet each operator has an obligation to do all in his power to prevent fires.

The protection agency and the operator should mutually prepare an effective fire prevention plan for each area involved. To facilitate effective application of the plan, the operator should designate a representative to work with the protection agency at all times. Fire prevention during non-operating hours, weekends, and holidays should be provided. The necessary machinery should be set up to strictly enforce the needed prevention measures.

Adequate preparedness for fire fighting requires a good fire plan. This plan should include (1) the actions expected of the operator, (2) a detailed outline of the equipment, tools, men, overhead, and organization, (3) a clear correlation of the duties, responsibilities, and authority of the operator and the protection agency, and (4) the organization of the operator's crew into an independent initial attack force, ready to function. Organization of the crew should include adequate training of men and overhead. A large-scale map should show topography; location of roads, fire lines, and water chances; location of equipment; boundaries of merchantable timber; all areas of especially high hazard; and other important details.

This fire plan should be prepared jointly by the operator and protection agency. The local protection officer and the operator must then take steps to put the plan into effect in accordance with current and expected burning conditions. The plan should provide for adequate action during non-working hours, weekends, holidays, and shutdowns. To reduce the amount of written material, maximum use should be made of maps, charts, diagrams, and outlines.

Hazard reduction is an important phase of protection planning for logging operations. The fire hazard and risk usually increase with the cutting of green timber. This hazard and risk may continue for a number of years following completion of the operation. Slash, debris, or brush resulting from logging should be treated in such manner as to assure as nearly as possible the same degree of protection as was available prior to cutting.

Money spent for slash disposal usually should be considered as money spent for fire protection. In many areas, complete disposal has been replaced by increasing supplemental protection combined with partial disposal or no disposal. Slash and snag disposal methods and needs vary with locality and timber type. Yet the same general purpose should apply —we want to purchase the best protection for the dollars spent.

As used here, protection costs include slash disposal, preparedness, and fire suppression. They should be compared to the potential damage. To buy the most protection per dollar spent, we must have basic information on certain items. We need to know the hazard of slash fuels and be able to estimate the potential cost of their protection. We need to know also, in definable terms, the amount of slash we can tolerate when attempting

to calculate the risk. We need to know the rate of natural hazard abatement.

For the white pine type, the University of Idaho School of Forestry is financing research, under the direction of Dean Jeffers, to provide this and other information. Comparable projects are needed for some of the other timber types and localities. A few such studies are probably under way, some have been completed, and the information provided contributes to better fire protection for logging operations.

A slash and snag disposal plan should be prepared prior to logging. The purpose of this plan should be: (1) To reduce the chance of fires starting; (2) to reduce the chance of fires assuming rapid headway; (3) to make control easier, more rapid and certain; and (4) to provide the methods that will be adequate and least costly. Benefits and damages, irrespective of fire protection, must also be considered in making the plan. Advance planning is needed to provide for supplemental protection if the plan calls for living with a substantially greater hazard for a number of years after logging moves to another area.

In the Northern Region of the Forest Service, there is evidence to indicate that after cutting, the ignition rate more than doubles, and that twice as many fires will reach a size of 10 acres or more. This indicates that the protection load increases with cutting. Higher protection costs can be expected and should be planned for in advance.

Adequate protection roads are of great importance in holding these costs down. Permanent or semipermanent protection roads should be designated at the time the operation is planned. The roads that will be maintained for fire protection purposes following completion of the operation should be constructed to a satisfactory standard to fulfill protection needs.

Slash disposal should be considered in planning cutting areas. This may assist in avoiding the creation of large continuous areas of heavy slash. It may also facilitate handling of slash disposal by suitable methods and reduce the risk to high values.

On a logging operation we have great economic values at stake. The magnitude of the potential loss through fire fully justifies intensive protection, which should include fire prevention, preparedness, slash disposal, and suppression.

Fire prevention should be designed to prevent fires starting on the operation and places on the operator an obligation to do all in his power to prevent fires.

Preparedness should provide organized, trained, and properly equipped fire-fighting crews. We must also have correlation of duties and responsibilities of the operator and the protection agency in the event a fire does start.

Slash disposal is considered mainly as a protection measure. Where slash disposal planning contemplates a substantial hazard for a number of years following logging, supplemental protection should be arranged for. We should consider all benefits and all damages of hazard reduction work and plan our program primarily for buying the most protection with the money invested.

For successful suppression, there must be no holding back on initial attack by anyone in position to help. All operators should prepare their organizations as effective initial attack forces.

MORGAN PLOW HITCH

Donald J. Morriss

Supervisor, Pisgah-Croatan National Forests

George P. Morgan, mechanic foreman on the Pisgah National Forest, has invented a remarkably effective mountain fire line plow hitch.

Tests have shown that plows held in the ground by hydraulic lifts require constant depth adjustment by the tractor driver. That presents difficulties in steep country since our operators have only two hands. On the other hand, lines made by free floating plows usually have considerable skip due to frequent changes in grade and soil structure, and the presence of logs, leaves, roots, and rocks. The Morgan plow hitch is designed to eliminate these problems.

Figure 1 illustrates the geared hitch, one of the unit's unusual features. When the tractor starts up hill the draw bar goes down but the plow beam is raised, thus preventing the plow from going so deep that it puts an added strain on the tractor. When the tractor starts down hill the plow is thrown into the ground, thus avoiding the skip which usually occurs with a free floating plow unless it is set unnecessarily deep.

The pressure bar, which is fitted on the pantagraph principle, accentuates this action. It also maintains a constant pressure on the plow at the point which will best hold it in the ground and level. A hairpin bolt holds the bar at an adjustable position between uprights that are pinned to channel irons on the top plate of the plow and may be adjusted forward and back (figs. 1 and 2).

Once the pressure bar is properly set, further adjustment while plowing is not necessary. This is an important improvement since it removes the temptation to throw on rocks while plow is in motion and the even more unsafe practice of jumping on the back of the plow to hold it in the ground.

One man can raise the plow point to the position illustrated by pulling up on the pressure bar. It can be held in this position for deadheading by inserting a bolt in the upper hole at the end of the beam. The plow is raised for loading by a hand-operated, 500-pound, safety wall winch. The crank handle is mounted to the right and behind the tractor seat. In loading position, a lock is dropped over the hitch to prevent side sway. The operator raises or lowers the plow without leaving the tractor seat.

Morgan has added some improvements on the plow itself. Plows will hang under roots and then it is necessary to back up. A plate that curves from near the plow point to meet the upper plate at the back end of the plow near the top of the wings has been added to act as a sled to raise the plow when backing.

The throat of the beam, beginning from well ahead of the plow point, is shaped in a perfect arc. This permits the accumulated leaves, which are too light to roll with the sod, to roll out on each side before they pack sufficiently to pull the plow out of the ground. Two beams, as well as the hitch parts, are cut from a single steel plate with practically no waste of material.

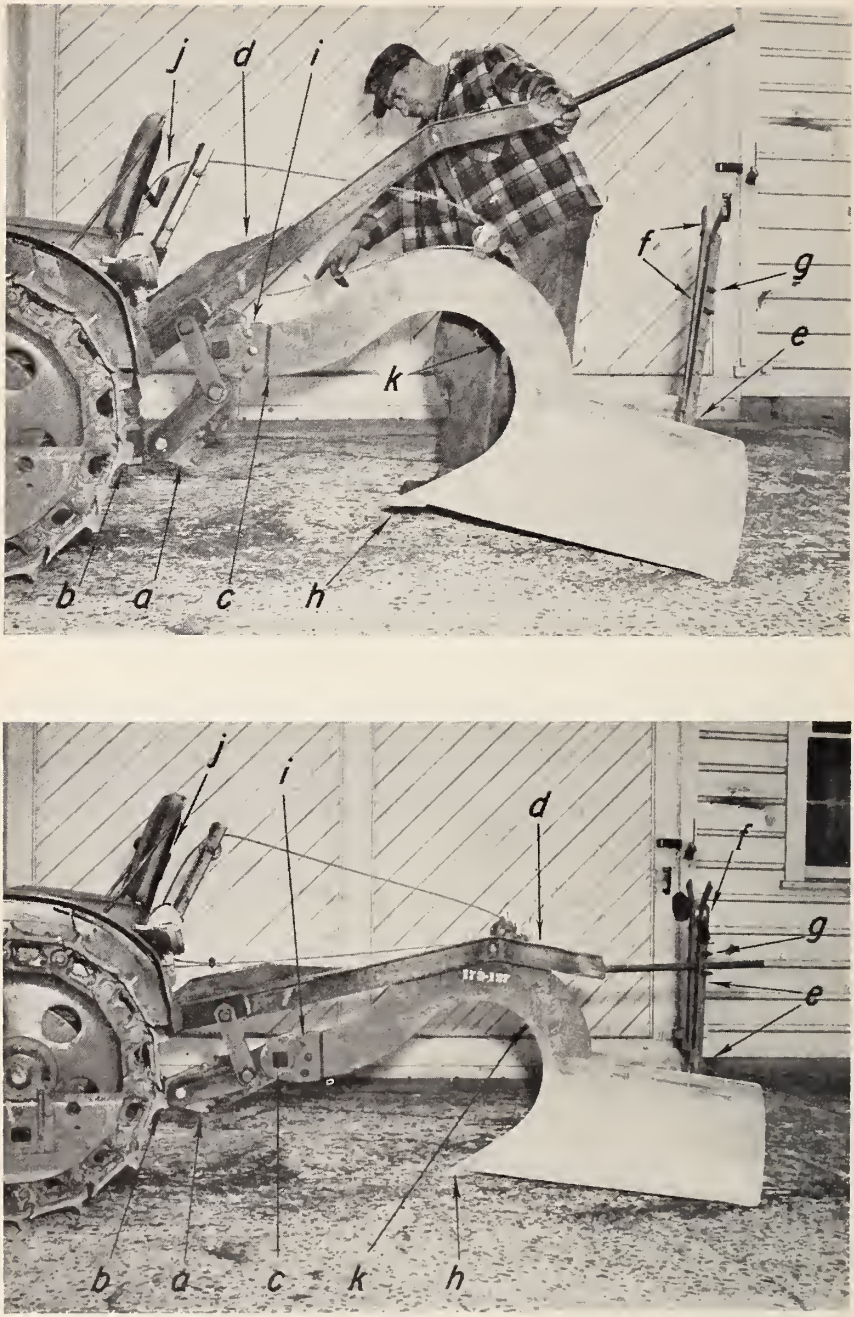

FIGURE 1.—The Morgan plow hitch: *a*, Geared hitch; *b*, draw bar; *c*, plow beam; *d*, pressure bar; *e*, point of pressure; *f*, uprights; *g*, hairpin bolt; *h*, plow point; *i*, hole at end of beam; *j*, crank handle; *k*, throat of beam. *Top*, George Morgan with plow point raised to deadheading position; *bottom*, plow ready for use.

FIGURE 2.—Rear view of plow showing placement of uprights.

The net effect of these features is a plow which follows the tractor like a snake crawling over a stick. Pulled by an 18- to 25-hp. crawler tractor, it makes a good line up a 30-percent slope, down a 60-percent slope.

Further information concerning this equipment may be obtained from the Regional Forester, U. S. Forest Service, 50 Seventh St., N.E., Atlanta 5, Ga.

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SO YOU HAVE TOO MANY FIRES!

HENRY SIPE

Assistant Forest Supervisor, Cumberland National Forest

The Cumberland National Forest in eastern Kentucky is typical of many forest units in one way: most of its fires are caused by local residents. Lightning and "tourists" are minor factors. The Forest protects a million-acre "checkerboard" where "Uncle Sam" owns the black squares and private parties own the red. About 50,000 persons live on the red squares, and another 50,000 live in towns under 5,000 population within the protective area. When land purchase was begun in 1934, 400 to 500 fires burned each year, doing plenty of damage. Woods burning had been practiced for generations. In the succeeding years, by various methods, we were able to reduce the number of fires substantially. In 1941 we had 192 and in 1950 there were 52, which seemed to be an irreducible minimum.[1]

Indeed, most of this million-acre protective area was practically free of all fires in 1950 except an occasional "accidental" one or a railroad fire. But in certain small sections, the occurrence rate was still very high, mostly from smokers or incendiaries. People over the whole Forest had in past years been exposed to considerable fire prevention pressure. Yet these small trouble spots remained. Law enforcement as always, offered hope, if enough evidence could be uncovered. But the culprits had become wary. What was the answer? It was felt some phase of education had to be selected; but what specific kind?

The results secured is one 12,400-acre unit on the Cumberland had been good.[2] Personal contacts and letter follow-up was the method used. In this area, the number of fires dropped from 10 in 1946 to zero in 1950. To date in 1951, one fire debris burning has occurred. If there is no more than one fire every other year here, the irreducible minimum has been reached.

This personal contact program has been carried out in several other areas with success. They total some 50,000 acres, about 5 percent of the Forest's protected acreage. It was found that many of the local residents had concluded that fires were harmful and should be stopped. But a certain type of person in the community refused to accept the opinion of the majority. In this group were the incendiaries, the careless "smokers," and the intentionally negligent. Here were the trouble makers of the community—the moonshiners, drinkers, and pranksters. Most of the good citizens welcomed any pressure put on these bad actors, but the pressure must come from the "outside." Why? For fear of reprisals. And this fear is not only that your barn may be set afire; you just like to keep the good will of your neighbor, whether he is a good citizen or a scoundrel. So someone charged with the responsibility, and who has the authority, must put on the pressure. Someone who *wants* to prevent fires, must *convert* that want into an *action* program.

[1] See July 1949 issue of Fire Control Notes, p. 33.

But, you say, all our folks have been "contacted." Probably so, but how long ago? Has the contact been kept alive? How about new families moving in? In one area of 175 families, at least 45 families have moved in or out, or to some other part of the section in a 2-year period, about 13 percent turnover a year. We found no substitute for personal contacts on these high risk areas on the Cumberland. Here is how it is done:

On the fire occurrence map, draw a line around those areas where there are too many fires. List them in priority order; worst first. Cut out a section of the map covering the worst area and fasten it to a piece of cardboard about letter size. Cut it in 3 pocket size sections. Then make a looseleaf notebook, pocket size. Likely there will be an employee or a local person who knows the names and location of residents in the area. With his help, put a numbered dot on the map for each family. Then number a notebook sheet for each, write on it the name of the head of the family, address, and brief notes about them. List schools, churches, and stores. The local ranger or guard who has been responsible for fire control in the area, should be with you on much of your work. If he has been unable to "crack" the fire problem, an outsider should be chief contacter.

Now go to the county school superintendent's office. List the names of pupils, parents, and teacher, and the ages of pupils. Talk over school problems with the superintendent and attendance officer. For example, what older boys play "hooky" too often. Next visit the county court house. Look over the civil and criminal order books. You'll be surprised at who is in trouble for what. Talk to county officials. Try to learn which are the best families, and the worst. Visit the schools first if possible. Make a talk even though it's only a 5-minute one. In some way let it be known that you have their names or know who they are. You might call the roll and check those present against your list. Or you might pick out and call by name some pupil you can identify. Take a picture of the pupils and present an enlargement to the school later.

Then start out and make as nearly a 100-percent family contact as possible. Write down names and approximate ages either during or right after the talk, together with any interesting notes. Find out who is related to whom (but watch out for marital troubles). Kinship will explain many things. For example, two men married sisters; they lived 5 miles apart. When we had a "run-in" with one man, the other set a fire. We didn't wise up till we found out they married sisters. Learn, too, who doesn't like whom. Often they'll inform on each other.

Pay particular attention to teen-age boys who are not attending school; maybe inquire casually about draft eligibility. If you have fires that are classed as incendiary, smoker, or unknown, there is a good chance some teen-agers are mixed up with them. Too often, such a footloose boy is overlooked or avoided in our contacts. Often he's not at home or slips out the back door when you call.

You will not be able to see all of the families, but later trips will tend to raise your percentage. Trying to figure out who are "key" individuals, and seeing only them, will be inadequate in these high risk areas. The important point to remember is that you not only want to make an impression on as many local folks as you can, but you want *them* to realize *they* are making an impression on *you,* and that they *think* you will remember *them.* The

[2] See October 1950 issue of Fire Control Notes, p. 1.

various psychological approaches to be used are beyond the scope of this article.

When you return to the office, mail something to each family. We include them on our quarterly Newsletter mailing list. The letter tells current conservation news—local, Forest, State, and Nation. We prefer to write the person's name rather than "Boxholder" because it adds the personal touch. All letters to one post office can be tied in a bundle with the address only on the top one. A Smokey Bear stamp can be used to seal the letters and save stapling. Other types of conservation material can be mailed as needed.

Visit the area twice the first year and if results are OK, reduce the frequency the second year. After the first year you will likely be able to put your finger on the fire suspects. Get better acquainted with these.

If there are fires in the area, of course investigate fully. You'll be surprised how much easier it is, than if you go into an area "cold" or unacquainted. Even though you don't get enough evidence for prosecution, you will likely learn who caused the fires and what's more important, they'll know that you know. Keep them guessing as to possible prosecution.

Go through this procedure for other critical fire areas. A contact program as above outlined is basicly being a good neighbor. If it solves the fire problem, other objectives such as sound cutting practices on private lands loom immediately ahead as even bigger challenges.

INFORMATION FOR CONTRIBUTORS

It is requested that all contributions be submitted in duplicate, typed double space, and with no paragraphs breaking over to the next page.

The title of the article should be typed in capitals at the top of the first page, and immediately underneath it should appear the author's name, position, and unit.

Any introductory or explanatory information should not be included in the body of the article, but should be stated in the letter of transmittal.

Illustrations, whether drawings or photographs, should have clear detail and tell a story. Only glossy prints are acceptable. Legends for illustrations should be typed in the manuscript immediately following the paragraph in which the illustration is first mentioned, the legend being separated from the text by lines both above and below. Illnstrations should be labeled "figures" and nnmbered consecutively. All diagrams should be drawn with the type page proportions in mind, and lettered so as to permit reduction. In mailing, illnstrations shonld be placed between cardboards held together with rubber bands. *Paper clips should never be used.*

When Forest Service photographs are submitted, the negative number should be indicated with the legend to aid in later identification of the illustrations. When pictures do not carry Forest Service numbers, the source of the picture should be given, so that the negative may be located if it is desired.

India ink line drawings will reproduce properly, but no prints (blackline prints or blueprints) will give clear reprodnction. Please therefore snbmit well-drawn tracings instead of prints.

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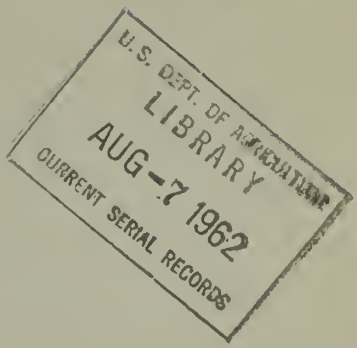

FIRE CONTROL NOTES

A PERIODICAL DEVOTED TO THE TECHNIQUE OF FOREST FIRE CONTROL

FOREST SERVICE • U. S. DEPARTMENT OF AGRICULTURE

FORESTRY cannot restore the American heritage of natural resources if the appalling wastage by fire continues. This publication will serve as a channel through which creative developments in management and techniques may be communicated to and from every worker in the field of forest fire control.

Volume 13 Number 2

FIRE CONTROL NOTES

A Quarterly Periodical Devoted to the TECHNIQUE OF FOREST FIRE CONTROL

The value of this publication will be determined by what Federal, State, and other public agencies, and private companies and individuals contribute out of their experience and research. The types of articles and notes that will be published will deal with fire research or fire control management: Theory, relationships, prevention, equipment, detection, communication, transportation, cooperation, planning, organization, training, fire fighting, methods of reporting, and statistical systems. Space limitations require that articles be kept as brief as the nature of the subject matter will permit.

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Forest Service, Washington, D. C.

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CONTENTS

TIMEKEEPING ON PROJECT FIRES

C. A. Gustafson
Chief, Division of Fire Control, U. S. Forest Service

Timekeeping is important to successful fire operations. It must be fast, otherwise much valuable time will be lost getting men on the fire line. It must be accurate to make certain each fire fighter will receive the wages due him and that the large amount of public funds paid out each year as wages to fire fighters is a true reflection of the total time worked—$6,000,000 is an estimate of the wages that will be paid fire fighters in fiscal year 1952. Timekeeping also provides means for identifying a fire fighter and permits immediate notification of the nearest of kin should death or injury occur, or notification of the fire fighter should sickness, accident, or death occur to a member of his family while he is engaged on a fire. It forms the basis for collecting suppression wage costs in trespass cases. It permits paying fire fighters quickly and with certainty that the amounts paid are correct. It permits identification of suppression wage expenditures so administrative studies may be made on all Class D and E fires—very important from the viewpoint of efficient financial management of fire operations.

ITEMS FUNCTIONALLY IMPORTANT TO A TIME REPORT

Since speed, accuracy, identification, dependability, etc., are important to timekeeping, the form used must provide a means of attaining these ends. It must provide space for the name and address of the fire fighter to permit identification and payment. It must identify the fire and name the forest on which it burned so financial management studies may be made. It must have space for entering place of hire and means of travel in order that correctness of travel time may be audited.

Different rates of pay apply to the various types of fire-fighting work. The timekeeping form should make it possible to enter the proper rate of pay. Travel time rates are usually at the lowest rate prevailing. The year, the day, and time of day "on shift" and "off shift" for each fire fighter is vital to accurate timekeeping. Many fires, particularly those of project character, require more than a single shift for their control. Total hours worked under each job classification is important to a calculation of the total gross amount earned. Also the fire fighter may buy a pair of shoes or some tobacco, or may fail to return certain properties charged to him. Deductions involving goods purchased by the fire fighter or government property lost by him will have to be made to arrive at the net amount due.

Space for recording travel time, hours worked, rate per hour, gross amount earned, deductions for purchases or property losses, net amount due, etc., must be made available on the timekeeping form. Sometimes different rates of pay apply if the employee is released, discharged, or quits, and this must be noted. The form should provide space for signatures of

the employee and the timekeeper. Signature of the employee will prevent future arguments concerning net amount due him for fire fighting, particularly when deductions have been made in the gross amount earned.

Last, but by no means the least important, is quick identification of the fire fighter for time reporting purposes, when going "on shift" or coming "off shift," by means of a detachable slip with a serial number identical to the number on the Time Report.

MECHANICS OF TIMEKEEPING

The job of keeping time can actually be made very simple if certain procedures are well understood and followed. It is the purpose of the following narration to outline how time of fire fighters may be kept with ease and still obtain speed, accuracy, and certain identification so essential in this phase of fire operations on project fires.

Forms, materials, and equipment.—A standard timekeeping form is necessary. Such a form has been prescribed for U. S. Forest Service use by the Comptroller General and is known as Form FS-874-15A TIME REPORT (Revised July 1948). The supply of these forms for any particular fire should be equal to about twice the number of fire fighters to be employed, with one ring binder for each 100 forms. They should be numbered in sequence, such as D-198000, D-198001, etc., to D-198100. The starting number, in this case D-198000, should be written boldly in ink on the cover of the ring binder.

Material available should include several small lined tablets about 8 by 10 inches, a pencil sharpener, a supply of 4-H pencils with erasers, a couple of filing spikes, and indelible pencils for signatures of employees.

Equipment required consists of a collapsible table of standard height, and about 6 feet long and 26 inches wide, 2 collapsible chairs, stapler, rope, and lights. A box with alphabetical separations should be available so time slips posted and completed for payment may be filed. A locked commissary box should also be provided.

Location of the timekeeping office.—The office should be outdoors; never in a building. It should be in the shade. If shade cannot be provided by a tree erect a fly over the selected office site.

The timekeeping office should be located out of the way of the kitchen, communication center, dust, etc. The men should be able to pass freely through the setup without congestion. For property accountability and commissary purchases, the locked commissary box and the sleeping gear should be near the tool dump. The men can be outfitted and then passed through the timekeeping setup prior to going on shift and can return equipment to the tool dump after property accountability has been determined when going off shift.

Preventing congestion.—After the timekeeping table has been set up it should be provided with roped lanes to force the men to pass the timekeeping desk in single file while going on and off shift, or obtaining commissary or bedding gear. Direction of travel should be indicated by signs.

Signing up the men.—There are a few common essentials required to start the timekeeping off right, whether at the employment center or after the men have arrived at the fire camp:

1. Have ready books of Time Report forms, 100 per book, numbered in consecutive order.

2. Fill out *one* Time Report for each man, again with such reports in consecutive numerical order.

3. Fill in the name of the fire and forest.

4. Fill in the employee's name; make sure full first and last names and middle initial are entered.

5. Fill in address of employee.

6. Enter place of hire and means of travel and whether government or private.

7. Enter job classification title at which hired and indicate hourly rate.

8. Enter in first column month, day, and year, e.g., 6/2/52, on the first line opposite the words "To fire."

9. Tear off stub and give it to the employee, advising him this is his *one* means of identification and to keep it until paid.

10. If the men are recruited at an employment center the book of Time Reports properly filled out is usually given the driver for delivery to the camp boss upon arrival of men at the fire camp. The men immediately after arrival in camp from the recruitment center are marched past the timekeeper so that a count may be made and travel time checked off.

If the men are signed up after they arrive in camp points 1 through 9 are carried out. In addition a check on travel time is made so that a complete record for each employee prior to entry on shift is obtained.

After completion of items 1 through 10 the job consists of recording the men on and off shift, posting time worked, and posting commissary and property losses for which the men are accountable.

On-shift timekeeping.—1. The men should be arranged in crews and each crew assigned to a crew boss or foreman. It is not essential under this system for the crew boss or foreman to have a list of names; he can obtain a list of identification numbers as the men pass through the timekeeping setup. Later, before beginning work, he can list their names for use in his supervision of their work for the shift.

2. The crew boss should walk his men past the tool dump so each man can be issued equipment for the shift.

3. The crew boss should next request each man to have available in his right hand his time report identification number.

4. They should then be requested to pass by the timekeeping desk in single file, and as each one reaches the timekeeper to hesitate a second or two to enable the identification number stub and the tools checked out to be seen.

5. The timekeeper notes the identifying number and the tools carried by the fire fighter. He writes the last three digits of the number and the tools to be charged the fire fighter on a lined tablet (a single sheet for each crew) somewhat as follows:

073—S F C (S—shovel, F—headlamp, C—canteen, etc)
081—M F C
087—A F C
101—S F C
etc.

Upon completion of taking the identifying numbers of the crew (the crew boss will notify him when this has been done), the timekeeper notes the month, day, hour and minute on the tablet sheet, tears it off,

and places it on a filing spike or a nail driven through a block of wood marked "on shift" for future action. This same system is followed until all outgoing men have been recorded. One man calling off identification numbers and tools charged and the timekeeper recording should be able to check out a man every 5 seconds or 360 men every half hour if the men are organized in crews that file promptly past the timekeeper.

6. Usually the night shift begins to report in shortly after the day shift has left camp for work on the fire. Each crew boss should march his men coming off shift past the timekeeping setup. The timekeeper notes the last three numbers for each man on a tablet sheet following the same procedure as for the outgoing men. After checking the last man in the crew (who will be made known to him by the crew boss) the timekeeper notes the hour and day on the sheet and places it on the spike marked "incoming."

7. Usually after the on-shift and off-shift men have been checked through there is a lull in the urgent timekeeping activity. Plenty of work remains but the timekeeper may do it more leisurely. The next job for the timekeeper is to sort the tablet sheets on which crews were reported and staple the on-shift and off-shift sheets for each crew together in readiness for checking property and posting time.

8. He then compares outgoing property charges with property checked in by each individual and notes discrepancies for future reference.

9. The next job is transferring time from these tablet sheets to the Time Report. This is usually done by one man calling out each number and the time on the tablet sheet while the second man locates the Time Report and posts the day, hour, and minute. As each crew boss tablet sheet is posted on the Time Report a figure 8 is written through it indicating the time for the crew has been posted.

This work is continued until all time has been recorded. Some timekeepers follow the practice of posting on-shift time as soon as possible after the men have gone on shift. This practice is approved and will ease the pressure should emergency timekeeping work come up.

10. Bedding must be issued to off-shift men. To assure property accountability they should file past the bedding gear to be issued bedding and then pass the timekeeper one at a time so he can note the last three numbers on each identification stub and the bedding gear to be charged. This need not be done by crews but some forest officer should be assigned to see that order and discipline in issuance of bedding gear is maintained. After the rest period, overnight or day time, one of the first duties of the men will be to turn in their bedding gear, going through the timekeeper in the same manner as when bedding was issued. As time permits the tablet sheets on which the bedding gear was charged will be checked against those reporting incoming gear to determine who hasn't turned in the property charged to him. If any individual cannot satisfactorily explain why he failed to turn in his gear, a "lost" property charge will be made.

Once it is known that strict accountability of property will be followed, it is surprising to see how few losses will develop. Sloppy property accountability on the other hand often results in intentional failure to turn in property, gross carelessness, etc.

11. The above sequence will be continued until the fire is controlled.

12. On every fire, men are released in small numbers or individually. Under such circumstances as each man is released, is discharged, or quits the timekeeper will complete the Time Report immediately by (a) calculating the total time worked under each job classification title, (b) entering travel time, (c) entering the appropriate rate per hour, (d) calculating the amount earned under each job classification title, (e) entering the gross amount earned, (f) determining deductions for commissary or property losses, and (g) arriving by subtraction at the net amount due. The timekeeper will identify the individual, obtain his signature, and after signing the Time Report, file it alphabetically in the card box.

13. When large groups of men are released simultaneously following control, the men are marched past the timekeeper so he can obtain each man's identifying number. The Time Reports corresponding to these numbers are completed in the same manner as in 12.

When enough Time Reports are checked to provide a truck or bus load of men, the numbers are called off one by one, the man holding the corresponding number stepping forward to sign his Time Report. If payment is not to be made in camp the men are immediately loaded on trucks or busses for transportation back to their point of hire. If they are to be paid they are grouped to one side to await preparation and receipt of the checks.

The above procedure is followed until Time Reports for all men to be released have been completed.

Camp and other "back of the line" workers must also be required to check through the timekeeper. The camp boss should see that this is done.

Fire overhead from the strawboss to the fire boss should be required to check through the timekeeper; the strawbosses, crew bosses, and foremen at the time their crews are being checked out; the sector bosses, scouts, etc., as they go on or off shift. Every man should be reported on a fire time slip regardless of his job on a fire.

Time of line equipment should be kept by the operator and reported to the timekeeper. After each shift the time claimed must be immediately checked by a forest officer in position to audit the time claimed. Usually this is the sector or division boss or someone else in over-all charge of the line on which the equipment worked. A similar procedure should be followed for all other special services involving rental rates.

Beer Cans for Wet Water

Field personnel on the Superior and Black Hills (and perhaps other) National Forests have been using wet water to a limited extent in forest fire control work. They have found that a pint beer can with cap makes a desirable field container for wet water. Wet water is canned in these pint containers and carried on fire trucks or stored in fire caches for ready use. For the brands of wet water used a pint is mixed as needed with 5 gallons of water in a back-pack can.

A suggestion has been made by Ranger W. V. Kennedy, Superior National Forest, to request manufacturers to package wet water in similar small containers. This request will be acted upon if results of the wet water project being conducted in California indicate such packaging to be desirable.—Division of Fire Control, *Washington Office, U. S. Forest Service.*

PARACHUTING HEAVY CARGO

Aerial Equipment Development Center
U. S. Forest Service, Missoula, Montana

A study of aerial activities during recent years has revealed a particularly noticeable increase in the use of larger planes, both for freight and for crew transportation. This is not due entirely to availability. Records support the economy of using larger smoke-jumper crews on potentially dangerous forest fires. Although the contract rate is greater, the larger planes cost but little more on the longer trips, because of a much higher cruising speed. With little or no increase in cost and a substantial saving in travel time considered, the large ships are sometimes used for less-than-capacity loads, and space is often available for water or extra equipment that might shorten the control time on difficult fires. The greater carrying capacity, longer and larger freight compartment, and big doors make these ships suitable for many jobs which would not be possible or economical with smaller ships. Although these large planes cannot use many of the smaller fields, they are able to operate over a large area because of their greater cruising range.

The study also brought out that the larger planes of the DC-3 or C-47 type require considerably more maneuvering time over a drop spot and substantial savings could be made by a reduction of this dropping time.

The increased use of the C-47 airplanes for smoke-jumper attack on larger and potentially more dangerous fires has indicated the need to drop larger cargo bundles. Normally 30 minutes are required to complete the drop operation for a 16-man jumper outfit—eight to ten runs, depending upon the hazards of the approach and the time required for lining up bundles. At a cost of $195 per hour a considerable saving may be accomplished by reducing the number of cargo runs.

With such possibilities in mind the equipment development or equipment use program included the following:

1. Modification of the roller-platform for quicker reloading.
2. The investigation of the use of roller conveyors to handle materials inside the Ford and C-47 planes to speed unloading of cargo, and the use of large cargo bags and cluster parachutes for dropping heavy cargo.

PLATFORM FOR DISCHARGING HEAVY CARGO

A platform for discharging heavy cargo, or several bundles simultaneously, has been constructed and used successfully during 1950 and 1951. Materials dropped included a heavy lookout tower and house. Some slight modifications have been incorporated in the platform and detail drawings corrected.

This "C-47 Cargo Roller-platform" consists of an aluminum frame, 40 by 61 inches, in which are placed 23 aluminum rollers supported on each end by ball bearings for easy rotation under heavy loads (figs. 1 and 2). The deck between the rollers is constructed of .045 thickness

aluminum sheet and is so arranged that the rollers project about ¼ inch above the slots. A cam and lever is provided to raise the rear edge of the platform approximately 4 inches off the floor of the plane to discharge the load.

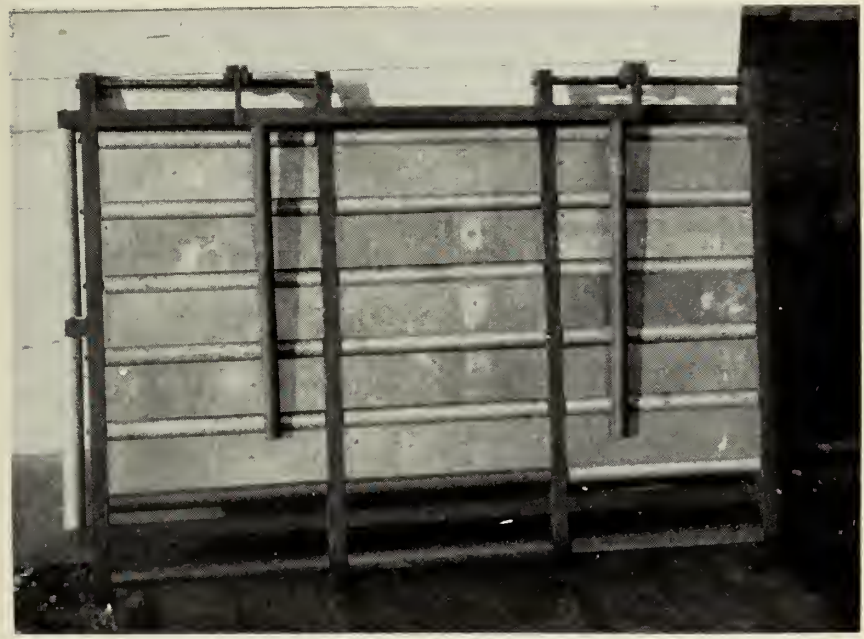

FIGURE 1.—Top of roller-platform as recently modified and strengthened.

FIGURE 2.—Bottom of roller-platform showing arrangement of framing members.

Placement or installation of the roller-platform requires only a few minutes. A sponge-rubber pad, about the size of the platform, is placed on the floor of the plane. The platform is then laid on the rubber pad and two guide and retainer pins, located on the outside edge, are placed in slots at the edge of the door. All C-47 and DC-3 airplanes have these slots built into the plane for other uses. The discharge lever or bar is hooked into place and the platform is ready for operation. When the roller-platform is resting on the rubber pad all the rollers are held stationary by friction on the rubber. This is important for safety in loading and to prevent accidental discharge of the cargo in rough air before the proper time.

Operation is extremely simple and, we believe, foolproof. The package or packages are placed on the platform with parachutes on top. Static lines are connected and the load is ready. At the proper time the operator pulls back and down on the discharge lever. If bundles are tied with heavy rope or have sharp projections it is desirable to place them on a sheet of scrap cardboard to insure a positive and immediate start without assistance.

In testing and using the roller-platform we have had no failures in operation. The maximum load discharged at one time was 1,200 pounds. In all cases one man has easily operated the lever to raise the platform off the rubber pad and discharge the cargo.

Detail drawings and material lists for manufacture are available upon request from the Regional Forester, U. S. Forest Service, Missoula, Mont.

LARGE CARGO BAGS

The successful use of the C-47 cargo discharge platform for large and heavy packages, or for multiple drops, has made possible the use of large cargo containers which handle a complete 8-man or 16-man outfit (fig. 3). Although experimentation to date has been confined to a 16-man unit, it appears that the outfit should be developed around equipment for 8 men. Two units would then be dropped, at the same time, for 16-man crews. The 8-man unit would be small enough to drop from the Ford airplanes by means of a roller-platform or a roller conveyer.

Several factors must be considered in dropping large packages:

1. The large packages are less likely to "hang up" in tall timber.
2. Large packages require multiple parachutes which reduce oscillation and consequently landing damage and also reduce the chances for damage due to malfunction of one parachute.
3. Large packages reduce the time required in assembling tools and equipment on the ground.
4. While there is some chance of losing the large package through poor spotting, the cluster parachutes and large bundle are easy to find in dense timber. It is more common to lose a single small package, or spend considerable search time, as a result of malfunction of the single parachute.
5. Fewer parachutes are required with large packages as loads can be adjusted more easily to the capacity of the chute. The low-grade plywood platform can be used for a mess table and discarded. The canvas bag, folded, requires about the same space as a parachute for the return trip.

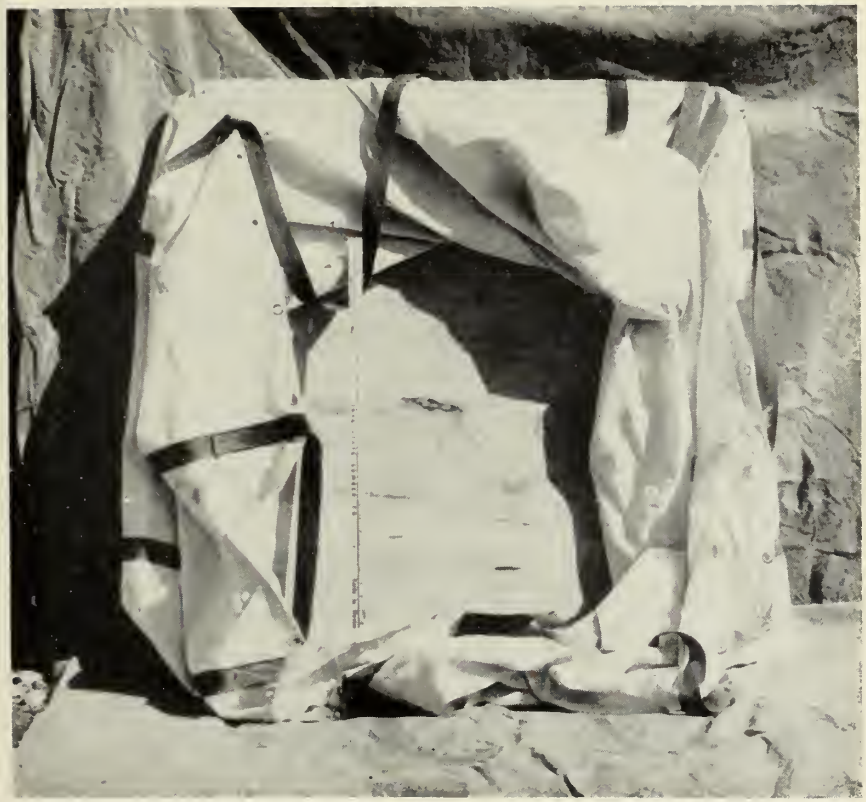

FIGURE 3.—Large cargo bag for carrying complete 16-man tool, subsistence, and camp outfit.

Experimental work has been conducted with a heavy cargo container large enough for a complete 16-man tool, subsistence, and camp outfit. Success with this bag should insure satisfactory performance with the container for an 8-man outfit.

The test bag was made of 12-ounce canvas reinforced with C-8 (2900-pound test) webbing at the corners and sides. A rough 5/8-inch plywood base 4 feet square is used as the bottom platform and stiffener for the bag. Corners are laced to facilitate packing and provide for removal of the contents in the event the load becomes suspended above the ground. Capacity is 64 cubic feet and when loaded with a 16-man outfit the gross weight is approximately 700 pounds. Four parachutes in cluster arrangement are needed.

The cost of materials and labor for the sample bag amounted to $65. Approximately 20 minutes saved in dropping time will pay for the container and we estimate the life of the container as six or seven trips.

Packing the container is important. Heavier packages should be on the bottom with the more fragile items, such as cans of water, placed on top. There are good possibilities of carrying fragile items in a container which is separated from the large bag by a 10-foot "lead" and arranged

to receive support of a large canopy area after the heavier package rests on the ground.

The 1952 program will include construction and test of a cargo bag or platform for dropping a complete 8-man unit. Detailed drawings and specifications for construction of cargo bag for a 16-man outfit are available upon request.

CLUSTER PARACHUTES

Cluster parachutes, two or more parachutes arranged to deliver heavy loads from plane to ground, have several distinct advantages:

1. Heavy loads can be safely delivered with a saving in flying time while over the drop spot.
2. In the event one parachute fails to open the remaining parachute or parachutes will retard the rate of descent and often land the load without damage. This safety factor is desirable in using surplus army cargo parachutes. These parachutes were made available at little or no cost but are not 100 percent dependable because of age and storage conditions.
3. Heavy loads are less likely to hang up in tall timber.
4. Parachutes are more easily adjusted to handle the weights and therefore a smaller number of parachutes is required when dropping large loads of equipment.
5. There is a saving in time required to assemble equipment on the ground.
6. There is less chance of losing a large package than a small one, particularly when a large number of packages are dropped.

In our experimental work to develop methods and equipment for using multiple parachutes we wished to utilize, so far as possible, standard cargo parachutes (fig. 4). We believe this will result in a minimum of modification and eliminate the need for stocking special parachutes.

Preliminary tests were conducted with small (12-foot diameter) flare chutes. Since their construction is identical to that of the 24-foot and 28-foot standard freight chutes, methods of packing, the cluster container, methods of extraction, and performance under load would also

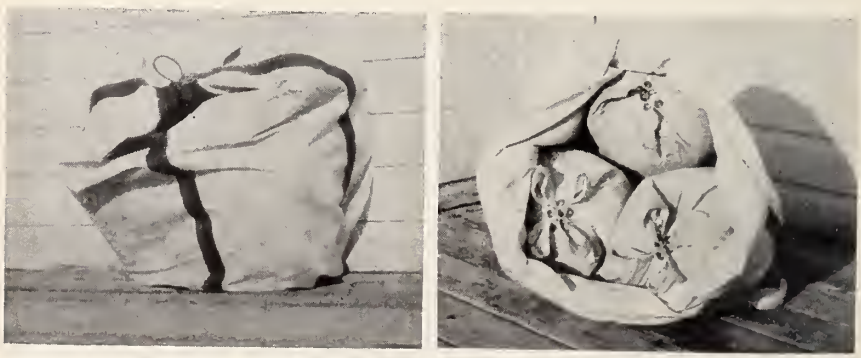

FIGURE 4.—Cluster parachute container. Holds 2, 3, or 4 standard cargo chutes for development in clusters.

be similar. Cost of testing and assembly was greatly reduced and test dropping could be done from smaller planes. After details were completely tested and developed with the small parachutes, the methods and equipment which proved best were used with the standard cargo chutes.

Two methods were selected, the difference being in the method of deployment.

Extraction by direct static line.—This method appears to be the most satisfactory and requires a minimum amount of special equipment and special packing.

A light-weight container is used to facilitate handling the parachute cluster in the plane. It contains a 40-foot webbing riser with two, three, or four leaders, each 10 feet long, at the upper end for attachment to the standard parachutes. Each leader has a loop sewn into the webbing for quick attachment and through which the standard freight riser is fastened.

The standard freight parachutes are opened and just enough of the apex on each chute pulled out of its container to circle it with stout rubber bands. The static line is then connected to the pull ring of each parachute to pull the canopies from the container.

Extractions by pilot chute.—This method is slower in action but also positive. It requires the addition of a small extraction chute which is operated by the static line. No lift is derived from the extraction chute after the cluster is deployed. Excessive stress is thrown on the apexes of the parachutes and reinforcement of the cluster chute apex is necessary.

It was believed that some increase in lift would be obtained from parachute clusters if they were "pig-tailed" or otherwise tied together. Normally the loss of air from each parachute causes them to repel each other, resulting in loss of lift. The arrangement of the pilot or extraction chute served to restrict the spread of the cluster and at the same time provided positive and simultaneous extraction.

Both types of extraction were tested successfully with no malfunctioning of parachutes or rigging. Analysis of packing operations and number of special items resulted in selection of the cluster arrangement which utilizes the direct static line for deployment.

Drawings, instructions for packing, and operational procedures are available upon request from the Regional Forester, U. S. Forest Service, Missoula, Mont.

Chief's Report Features Fire Control

The 1951 report of the Chief of the U. S. Forest Service is entitled "Natural Enemies of Timber Abundance." It prominently features fire as one of the natural enemies. The subject is discussed under the following titles: A complex problem. The status of protection today, Advances in fire-fighting methods and equipment. Forest fire research, Cooperative fire prevention campaign, Fire protection in civil defense, and Forest fires can be stopped.

PENNSYLVANIA'S FOREST FIRE PREVENTION PROGRAM

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Division of Forest Protection, Pennsylvania Department of Forests and Waters

How can forest fires be effectively prevented? This question, which has faced foresters and fire control personnel for over 50 years, has provoked tremendous amounts of research and innumerable solutions, methods, and practices.

At the turn of the twentieth century the forest fire situation in Pennsylvania was extremely serious. It was actually the primary reason for the creation of the Department of Forestry, now the Department of Forests and Waters.

To appreciate properly the extent of the forest fire problem, it is necessary to obtain some background. This is needed to understand fully the forest fire prevention and control work that has been accomplished in Pennsylvania.

Fortunately the principles upon which the Department's Protection Division was founded were sound and sensible. This can best be exemplified by the following statement on the forest fire situation from the Report of Operations of the Department of Forestry for the years 1908 and 1909:

> The problem of forest fires in Pennsylvania will be solved only by means of education and the help of the people in the community. As soon as the mental training of those who inhabit the mountains, towns and cities are brought to the plane where they will appreciate the wrong and useless destruction and the great loss not only to individuals but to communities, which are wrought by forest fires, just so soon will the moral sentiment of the community turn against this annual performance; and those guilty of starting fires either through malice or negligence, will and should be ostracised in the community and treated as criminals who commit the grosser crimes. But education, or the ability to know and discriminate, must be followed up by active, earnest, helpful, willing cooperation in an effort to prevent or speedily extinguish every forest fire.

With this type of thinking being done by the early leaders, it was possible for the forest protection forces to move ahead with a minimum of confusion or changes in policy.

The first prevention program in Pennsylvania was a broad plan of education for people to use care with fire in or near the woods and not start forest fires. It endeavored to teach people to appreciate the forest from a value and need standpoint. About the only fixed source of fire was the railroads and here early efforts were made to fireproof the rights-of-way with safety strips and to inspect fire prevention equipment on locomotives. Education was directed toward brush and debris burners. Sawmills were inspected with fire prevention in mind. However, the prevention effort as a whole was a general one with wide coverage.

As fire reports, together with forms, maps, and statistics, accumulated each new year, a more specific analysis of the fire situation in the State

could be developed. Special hazardous and high risk areas began to stand out in the various forest districts. These specific areas and their definite problems offered the chance for stressing prevention efforts.

State records in the early 1930's indicated that the size of forest fires and the total area burned had begun to be reduced, although the number of fires appeared to increase. This was due not to an actual increase in numbers of fires but to the development of an effective fire reporting system. Such an increase in number of fires reported, not only in Pennsylvania but nationwide as well, was a result of the expansion and increased efficiency of the protection organizations throughout most of the United States.

The law setting up the Department of Forestry placed all the forest land in Pennsylvania under protection from fire. However, it was not until 1920 that a satisfactory protection organization was effected and a district forester made responsible for each section of the State. By 1921 forest fire reporting had become sufficiently accurate that statistics set forth after that date can be used for comparisons.

For the 15-year period 1921-35 the State records show a total of some 48,670 forest fires reported. During 1936-50 33,830 forest fires occurred. This is a reduction of 14,840 fires, or an average of slightly less than 1,000 fires per year, over the previous period. During these same two comparable periods forest area burned was reduced from 2,367,000 to 756,000 acres, an average yearly reduction of burned area of more than 100,000 acres.

It is reasonable to assume that weather as a factor can be discounted to a large extent when a 15-year period is used for a basis of comparison. Therefore, it can be said that the large reduction in the number of fires reported during the past 15 years was primarily due to the prevention practices employed by the Department of Forests and Waters and others interested in conservation. The downward trend of the fire problem in Pennsylvania is shown in the following tabulation of the forest fire statistics by 5-year averages:

	Fires per year		*Area burned per year (acres)*	*Forest land burned (percent)*
	Number	*Average size (acres)*		
1911-15	1,066	340	362,379	2.40
1916-20	1,454	149	216,869	1.43
1921-25	2,832	79	223,680	1.48
1926-30	3,189	46	145,160	.96
1931-35	3,713	28	104,587	.69
1936-40	3,213	15	46,868	.31
1941-45	2,160	32	68,480	.45
1946-50	1,393	26	35,885	.24

The reduction in area burned can for the most part be attributed to the continued improvement in the fire control organization, techniques, and equipment. The trend in average size of the individual fire is downward so long as the control organization keeps pace with the prevention activities and vice versa. When either one or the other gets out of line this figure will fluctuate. This accounts for the low average area per fire during the 1936-40 period when the emphasis was on extinction while the fixed area prevention program was just getting underway.

The percent of forest land burned follows the general trend of the

State's protection activities as it moves downward with each passing period. The present goal is one-tenth of one percent.

The anthracite coal region of Pennsylvania had long been known to be an especially serious forest fire area. This was a general idea and not limited to any specific place. It was realized that protection appropriations and personnel were being used in this region considerably out of proportion to other forested areas in the State.

By 1936 many of the records and statistics had been carefully analyzed and an effort was made to stop generalizing and to correlate fire occurrence with fixed areas or political subdivisions. The only practical and established units in Pennsylvania were the townships. It was well understood that this was not an ideal breakdown since no two townships were alike in size, forest area, fire risk or hazard. It did, however, offer an existing unit that could be used annually for comparative purposes within set limitations. It provided established subdivisions for study and assignment of prevention projects.

Township maps showing spot locations of fires were pointing out certain outstanding problem areas. Annual tabulations of fires by townships were showing quite clearly the relative importance of these problem areas. At the close of the 1940 season, the fire statistics for the 5-year period 1936-40 were closely analyzed and the average occurrence of fires by township determined. These studies pinpointed the areas of high fire occurrence. The figures for this period were then set up as a standard for future planning and evaluation.

In general it was noted that fires occurred in practically every part of the State. However, any unusual number of fires in any one township was taken as an indication that a definite fire problem existed. As a fire occurrence standard for designating a township as a problem area, the figure of 10 fires per year, based on 5-year averages, was arbitrarily chosen. The original list placed Hazle Township, Luzerne County, at the top with 99 fires per year. Altogether the list contained 48 townships each having more than 10 fires per year.

When it is considered that there are approximately 1,600 townships and civil divisions in Pennsylvania, it can be readily seen what a small part of the State was included in this list of problem townships. Further study, however, revealed that these 48 townships accounted for 35 percent of all the fires in the State but included only 5 percent of the total forest area of 15,127,640 acres. These townships, then, were the problem areas on which specific prevention practices could be concentrated.

During the spring of 1940 the first concentrated effort on specific prevention projects was made. The initial phase of the plan was to assign twelve young foresters to the projects, one man to several of the townships having the highest fire occurrence.

They were given lists of suggested activities, maps, and fire occurrence tabulations and charged with the task of making a definite plan for the prevention of fires in their assigned areas. Suggestions were made that they work with local officials, resident groups, and others in order to encourage cooperation, plan prevention, and promote educational programs for the people. This phase of the program was later followed by assigning certain forest inspectors (nontechnical fire control personnel)

to specific townships to work with the foresters in setting up actual prevention projects.

These projects included safety strip work along railroad rights-of-way. Here a 100-foot strip was burned out for the distance necessary after a bulldozed or hand-raked back line had been constructed down to mineral soil. All together there are over 300 miles of such safety strip maintained in the State to prevent railroad fires.

Many of the small mining communities in the coal region located adjacent to forest or brush land were causing innumerable debris and brush burning fires every year. To overcome this problem safety strip projects were set up. These consisted of bulldozing or hand digging a fire line adjacent to the wooded areas and control burning the flammable material, weeds and brush, between it and the community. This treatment tended to fireproof the area and thus prevent fires from occurring.

The playgrounds, sports fields, and recreational areas which were determined to be potential fire hazards were treated similarly each year. Areas along roads and highways known to be hazardous were also given the safety strip treatment. In most cases this entailed control burning the grassy areas adjacent to the roads, or hazard areas, the distance necessary to make it safe. The need for a back line depended upon the local conditions. In most cases careful control burning precluded the need for such a back line. In cooperation with the local officials city and local dumps, which are always a fire hazard, were also safety stripped.

In addition to these projects concentrated prevention education was carried on in the areas which showed a preponderance of forest fires. The idea was to fit the prevention means, methods, and media to the immediate problem and type of people concerned. For this purpose a large amount of specially designed, mimeographed prevention material was prepared.

As a means of quick suppression and also for on the spot prevention work, the number of 1- and 2-man smokechaser units was increased during the fire seasons in these problem areas. The very presence of these men was extremely helpful in preventing fires, from a psychological standpoint in addition to the assigned work which they did.

In the areas where this specific prevention work was in effect the 5-year average of fire occurrence from 1940 to 1945 showed a marked reduction. The average number of fires per year for all 48 townships, plus 4 more which entered into the more-than-10 fire class during this 5-year period, was 652 or 30 percent of the 2,160 fires for the entire State as indicated in the following tabulation:

	Average number of fires per year		
	1936-40	1941-45	1946-50
All 52 townships with high fire occurrence	1,136	652	288
State	3,213	2,160	1,393

Further analysis showed that the reduction in number of fires amounted to 42 percent in the 52 townships given treatment as compared to 28 percent for all other townships.

During the 5-year period ending in 1950 the prevention work was continued or intensified in these areas. Every effort was made to put in a suggested remedy for each fire that had occurred. Again the number of fires was substantially reduced, and, for many of the townships, car-

ried well below the 10-fire mark and held there. Hazle Township, Luzerne County, which had led the list with an average of 99 fires per year, now had an average of only 5 fires. The following tabulation shows the progress made in reducing the number of fires in the 12 counties at the top of the list in 1940:

Township and County	*Forest area (acres)*	*Average number of fires per year*		
		1936-40	1941-45	1946-50
Hazle, Luzerne	26,331	99	52	5
Foster, Luzerne	24,748	72	29	3
Mt. Carmel, Northumberland	10,286	63	12	5
Coal, Northumberland	13,387	55	14	3
Archbald, Lackawanna	9,518	53	9	10
Mahanoy, Schuylkill	10,259	42	26	8
Hanover, Luzerne	8,960	38	38	4
Kline, Schuylkill	6,462	37	23	7
Plains, Luzerne	7,473	32	6	6
Newport, Luzerne	7,067	32	14	2
Mauch Chunk, Carbon	24,892	32	29	12
W. Mahanoy, Schuylkill	4,070	28	23	8

For the 5-year period ending in 1950 the 52 townships had only 288 fires per year, or a reduction of 75 percent from the number that occurred during 1936-41. For all other townships the reduction was only 47 percent, and for the State as a whole 57 percent. This further emphasizes the value of specific treatment in areas of high fire occurrence. This reduction in fire numbers is especially interesting in that the number of persons using the woods during this period increased more than 50 percent over that of the previous 5 years.

After studying and observing the results of these prevention projects it is felt that outstanding progress has been made in Pennsylvania's forest fire prevention program. At present all but 5 of the original 52 townships have been removed from the problem list. One of these exceptions is Rush Township, Centre County, which is on the list primarily because of its size. It contains ten times the forest area of the average township, more forest area than each of 11 whole counties in Pennsylvania. The other four exceptions are townships in which this specific prevention treatment has not been applied as intensively as in the others.

Now that these problem areas have been brought back to average or better, the task ahead is to maintain or further improve the records. This leads to the next stage of planning for this purpose. At this writing a new list of townships has been made with the critical point for the problem area status set at 9 fires rather than 10. This list contains only 18 townships based on the latest 5-year averages. Plans have been made for applying specific prevention projects in each of these areas in an effort to bring the number of fires below the set critical point.

This does not mean that the work done in the original critical townships will be relaxed. Most of the projects will be carried on as before but possibly not to the same degree of intensity. Perhaps as time goes on and it is felt that the various problems are resolving themselves, the actual prevention work will be lessened to a greater extent. However, this will be gradual and dependent upon local conditions in each specific area.

This article is not meant to imply that this work is a solution to all of Pennsylvania's forest fire problems. It is well realized that only one fire occurring in the State at the right time and in the right place could burn

thousands of acres if it was not promptly and efficiently handled. The fact remains, however, that for each fire prevented the chance of this happening is proportionally reduced. In addition, each fire prevented means the continued availability of the control force for the fire that does occur.

This prevention program in Pennsylvania is designed to stop fires by eliminating the source of the trouble which causes them. The program set up to do this has been successful and its potentialities cannot be overlooked. As has been pointed out, the program will be continued with higher goals for attainment established as the fire problems are reduced in numbers.

Somewhere along the line there is an irreducible minimum insofar as forest fire occurrence is concerned. However, we do not believe that this point has been reached as yet. Nor do we believe that it will be realized State-wide in 1 year or 10 regardless of the funds spent each year to achieve that goal. Rather the prevention program is continuous year after year, each period's accomplishment adding its weight to the over-all job to be done. Whether this program will eventually solve all the forest fire problems in Pennsylvania remains for the future to answer, but it is hoped that this type of program will enable the State to reach the point where forest fires will not be a threat to her 15 million acres of growing forests. In the foreseeable future, however, it will be necessary to maintain an alert, well-trained, and well-equipped fire control organization primed to handle both the prevention and extinction phases at all times and under any emergency.

Fire Pruning of Slash Pine Doesn't Pay

In a recent test where severe fires should have hastened natural pruning of slash pine, a small gain in pruning was offset by a loss in height growth.

On February 28, 1949, a class 5 fire day, head-fires were set in three plots in a poorly stocked plantation on an upland site in south Mississippi. At that time the slash pines were 9 years from seed and averaged 23 feet tall. The fires caused only 2 percent mortality.

Measurements in March 1951 showed that 2-year height growth of the slash pine was 5.3 feet on burned plots and 6.8 feet on adjacent unburned plots. This loss of 1.5 feet was almost equal to a half year's height growth. For trees of equal height at the time of the fire, the lowest live limbs in 1951 were 1.9 feet higher on burned trees than on unburned.

Even for very tall burned trees (40 feet high in 1951), the average height of the lowest live limbs was only 14.2 feet. Thus the maximum pruning accomplished by fire has not been great. Any fire intense enough to prune southern pines is likely to cause growth losses similar to those measured on these plots. In this plantation, it seems likely that natural pruning of the unburned trees will catch up with that on the burned trees in about 3 years, and that the principal permanent effect will be the loss of about a half year's height growth.—David Bruce, *Southern Forest Experiment Station.*

MICHIGAN POWER-WAGON PLOW

STEVEN SUCH
Engineer, Michigan Forest Fire Experiment Station

Undergoing extensive field tests in Michigan at the present time is a hydraulically controlled fire line plow mounted on the rear of the four-wheel-drive power wagon described in the October 1950 issue of Fire Control Notes. This plow is the result of 2 years' work directed toward the development of an efficient, practical plow unit for trucks in the power-wagon class (fig. 1).

FIGURE 1.—Michigan power wagon with hydraulically controlled fire line plow ready for use.

Originating as an idea in the field, the plow was designed and tested at the Michigan Forest Fire Experiment Station, with several other models preceding the one now being tried. The present design seems to best satisfy all the conditions required of such a unit.

Some of the features of this plow, including a simple mechanical linkage, are:

Double hydraulic action, permitting the plow to be lifted behind the truck as well as being pushed into the ground.

Cylinder-over-beam design to obtain the most efficient use of the weights involved and to gain the maximum compactness for transportation purposes.

Depth control mechanism in a convenient place for quick and simple adjustment of depth when drawbar height changes as a result of a fluctuating water load.

Spring action through an integrally mounted spring which absorbs shock loading while creating a constant down pressure.
Tracking action permitting the plow to follow the truck around turns.
Quick detachability.
High clearance.
Low drawbar power requirements.

The control mechanism for the hydraulic circuit is located in the cab of the truck and requires only a lift or a downward push on a lever to get the desired action on the plow. For carrying, the beam rises into a vertical position where it can be held by the hydraulic force of the cylinder if the plow is to be used intermittently, or it can be secured with safety chains when highway travel is anticipated (fig. 2). Down pressure can be exerted to the point of actually raising the back of the truck.

FIGURE 2.—Plow in vertical position secured by safety chains for highway travel.

When in operation, the hydraulic cylinder floats inside a larger cylinder. The floating action is obtained through the spring which is coiled around the smaller hydraulic cylinder. This feature is particularly desirable in rough country where long skips would be encountered with a stiffly mounted unit.

Because the truck bed rises as the water load decreases, thus changing the drawbar height, this condition is counteracted by the use of a depth control screw on the top of the beam at the rear of the plow. This screw eliminates a burdensome job of changing heights at the head of the plow. The principle involved here is simple, being centered around the pitch of the plow point. Any depth can be had by varying the degree of pitch. To insure a consistent pattern in operation between the rolling coulter and the plow bottom they are combined as a single assembly never

changing positional relationship through an entire cycle of depth adjustments.

Lateral or sidewise action takes place about a vertical pin which permits the plow to track freely after the truck even on the most acute turns. This action is necessary to minimize lost line. When being lifted on side slopes the plow swing is controlled by positive stops, and at the top carrying position it swings into a central position by a cam-like action about the vertical pin.

Maximum plowing depth is about 4½ inches, this depth being governed by wide flanges on the sides of the rolling coulter. The width of line at this depth averages about 54 inches, depending somewhat on the soil and cover types.

The use of a middlebuster type bottom with moldboard extensions, and the addition of turf knives, gives a most satisfactory, clean-cut line of suitable width for the purposes intended for this unit (fig. 3). This combination of bottom and turf knives creates the least amount of resistance to forward motion of any bottom tried to date. The entire bottom, with the exception of the turf knives, can be purchased commercially, as can the 18-inch diameter rolling coulter used. The extensions on the moldboards have been a helpful addition to the plow in that they hold and push aside the furrow slice, thus reducing the amount of lost line.

Total weight added to the power wagon by the installation of this unit is close to 700 pounds. This includes all the parts of the hydraulic devices, the castings, and the plow. It should be pointed out, however,

FIGURE 3.—Clean wide line made by power-wagon plow.

that close to 80 percent of this weight is on the plow when it is operating, and only 20 percent is carried as dead or nonfunctional weight on the truck.

The discriminate use of castings to combine functions and to simplify production has minimized work time necessary for manufacturing as well as greatly improving the ultimate design of the plow and its attachment to the truck.

Every effort has been made to reduce the cost of this unit to an absolute minimum without sacrificing quality, strength, or safety. At the present time no definite figures can be given on the exact cost of the completed outfit as installed and ready to work.

Future plans include similar hydraulic plow adaptations to crawler type tractors. In regard to power-wagon usage, further refinements unquestionably will arise, and already in the thinking stage are multiple uses for a form of hydraulic power package unit of which the plow would be only one element. Other tasks requiring a large force, such as lifting, pushing, or carrying, offer possibilities for expanding the use of the hydraulic units on four-wheel-drive trucks just as it has on crawler tractors.

Additional information on the power wagon and the power-wagon plow may be obtained from the State Department of Conservation, Lansing, Mich., or from the Michigan Forest Fire Experiment Station, Roscommon, Mich.

Improved Support for Fuel-Moisture Sticks

Ever since the fire danger rating system has been in effect fuel-moisture stick supports have been unstable. To overcome this a new support has been devised (fig. 1). It can be used with either the early standard system or the newer, open type station.

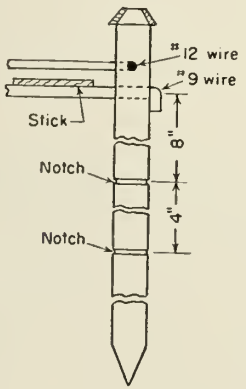

FIGURE 1.—Drift pin support.

Four iron drift pins ½ by ½ by 24 inches (or square or rod iron) are drilled 1 inch below the top with a hole large enough for No. 9 galvanized wire. Two pins have another hole drilled at right angles ¼ to ⅜ inch above the first. No. 9 wire runs through the lower holes to support the sticks; the other holes are used for wire laid across the top of sticks to hold them in place. File a notch around each pin 8 inches below the 1-inch hole, and a second notch 4 inches below the first. The first marks the top of leaf litter or ground level depending on the system used. The second notch marks ground level for open type stations.

Little can be held in place by using 2-by-4's around the screen supports. A neater, trimmer job is gotten by using a piece of 4-inch wide zinc. Leaf litter is covered with 2-inch mesh wire.—E. B. OLSON, *Cheat District, Monongahela National Forest.*

A FIRE-WHIRLWIND OF TORNADIC VIOLENCE

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Whirlwinds occasionally have been reported occurring within various types of fires. Accounts sufficiently detailed to give the reader a definite idea of what the reporter had actually seen are rare. Since the fire-whirlwind is a phenomenon of considerable importance to fire fighters, I will attempt to describe one which was observed by Robert S. Stevens, Forester, Oregon State Board of Forestry, and myself at 2 p.m. August 23, 1951, on the Vincent Creek fire in southwest Oregon. Figure 1 portrays the spectacular wind conditions.

From our vantage point about 200 yards away it was evident that violent whirling surface winds existed over a diameter of some 100 to 200 feet. In the middle of this circulation was a dark tornado-like tube which extended upward, the top being obscured by drift smoke above approximately 1,000 feet. The winds in this tube were so extreme that a green Douglas-fir tree, which at breast height was about 40 inches in diameter, was quickly twisted and broken off about 20 feet above the ground. In the area of the whirlwind, the fire flames leaped several times higher than those surrounding. A large tree top burst into flame like the flash of a powder keg when the whirl passed by. Within the tube, gases and debris were moving upward at a high velocity. The whirling column remained nearly stationary during its activity, moving little more than 50 yards. Had that not been the case, extremely rapid fire spread might have resulted. The whirlwind rapidly disappeared and as rapidly reformed a moment later, repeating this procedure at least 3 times during a 10-minute interval.

The general fire was on a 50-percent south-southwest slope. The trees were widely spaced with fuels consisting of low brush, weeds, snags, and down logs typical of an old burn in this region. The fire front was moving steadily along the contours and extended up the entire slope, about one-half mile from top to bottom. Flames along the front were about 5 feet in height. Shorter flames persisted to a distance of about 50 feet behind. A slight spur ridge projected from the slope so that updrafts were moving from both the south and the southwest into the area of the whirlwind. The fire-whirlwind developed a few feet behind the fire front 150 yards from the summit of the main ridge and on the spur ridge.

The meteorological condition of the atmosphere was one of conditional instability. Overturning of the air in the lower layers could readily occur if the surface were heated sufficiently. No cumulus clouds were to be seen. Winds at ridge top were north-northeast from 10 to 15 miles per hour. Above the ridge top level, winds were from north-northwest to

[1] The diagram was prepared by the Pacific Northwest Forest and Range Experiment Station draftsman.

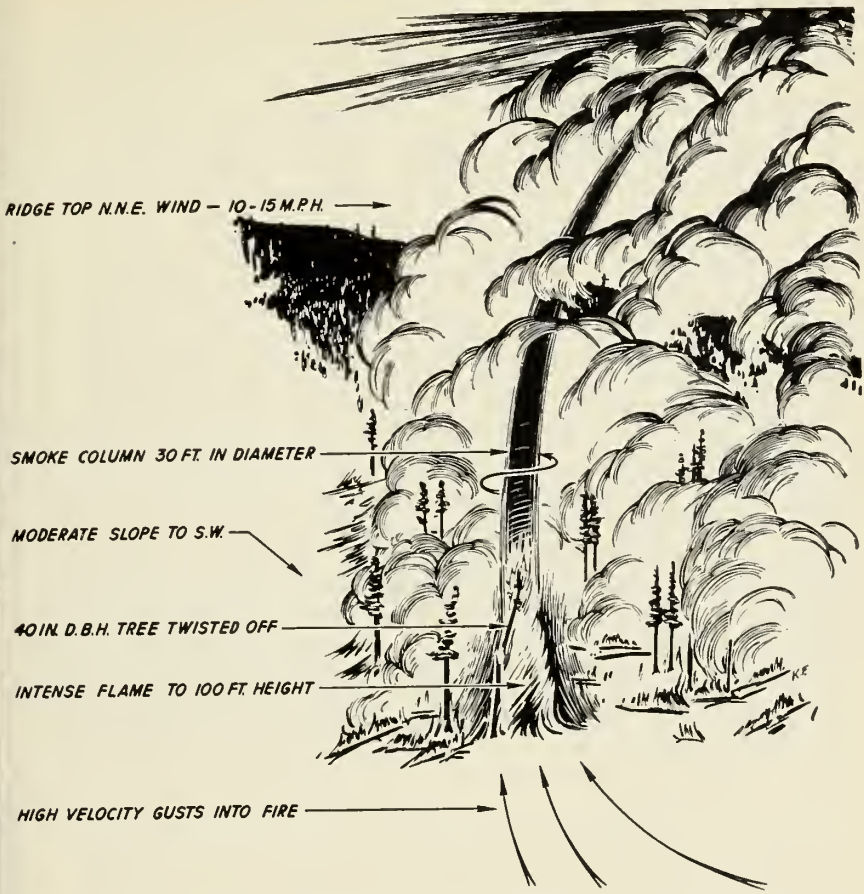

FIGURE 1.—Diagram of fire-whirlwind observed at the Vincent Creek fire.

north-northeast and ranged from 8 to 16 miles per hour up to 10,000 feet. The relative humidity was 46 percent and the temperature 67 degrees, neither being unusual.

There has been much written on various types of whirlwinds and their causes. Much is yet to be learned. Meteorologists know that these whirlwinds at present only where the atmosphere is in a particular condition of unstable equilibrium—where the temperature decreases so rapidly with height that the warmer air below, being lighter than the cooler air above it, tends to rise, and conversely, the cooler air aloft tends to sink. The result is intense vertical currents throughout the unstable layer.

In this case, we have the heat from the fire which caused the unstable conditions. However, this is an entirely normal situation over a large fire. Since these violent fire-whirlwinds are infrequent, there must be some condition other than heating to cause their formation. Perhaps the answer lies in the interplay of wind currents and topography. In the case under discussion, consider the position of the whirl near the top of a sunlit

south-southwest slope where it was fed by upslope drafts from the south and southwest in the surface layers. Above the level of the ridge the rising currents from the fire were played upon by the prevailing gentle to moderate north-northeasterly wind. Perhaps herein lies the answer. There were two opposing air currents with a column of rapidly rising gases between. This is an ideal condition for the formation of mechanically induced eddy currents. An eddy current, once started, might be sustained by the energy of the rising hot gases. This theory is substantiated by the repeated reappearance of the fire-whirlwind in the same spot. As the leading edge of the main fire progressed, the fuels in the area of the whirl were consumed and the volume and heat of the ascending gases became apparently insufficient to support the whirlwind. As the fire moved on to new fuel and new topographic features no further disturbance was noted.

From this analysis it would seem likely that there are certain ideal combinations of conditions under which this type of fire-whirlwind of extreme violence might occur. The necessary factors seem to be for the fire to be on the lee slope sheltered from the prevailing ridge top winds, a moderate or stronger wind at the ridge top and strong converging surface updraft currents along the burning or sunheated slopes. It would be desirable to have the necessary combination of conditions more positively identified so that fire fighters could learn to anticipate at least this one type of blow-up fire behavior. Additional detailed accounts of similar phenomena would contribute to the understanding of their causes and their effects on fire behavior. These accounts should attempt to describe the topography, surface wind, ridge top wind, fire intensity, cloud types, smoke column characteristics, and the intensity of the fire-whirlwind.

RECENT DEVELOPMENTS IN SOUTHERN FIRE CONTROL [1]

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The statements made here are meant to have application only to the 11 southern States. The thoughts and facts presented are not just my own. In evaluating and choosing for this paper those developments which must be credited with exercising the more significant and valuable effects, I have had the benefit of advice and suggestions from a cross section of men long and intimately familiar with southern forest fire and timber management problems.

For anyone properly to appreciate and measure the meaning of these developments, it is necessary first to have a general picture of the situation as it existed in the South only a few years back.

In round figures, there are 180 million acres of forest land in this area —about one third of all commercial forest land in the United States; land which now grades all the way from denuded of commercial tree species up to heavily stocked with high-value timber growth. Due in part to our long growing season and the nature of our tree species, these lands as a whole have the highest wood-yielding potential of any major area in the United States. This area can—and some day will—be this country's superior wood-producing area. One can safely say that the South would be occupying that position today except for one factor: The historic prevalence of an immense and widespread fire problem.

It would be oversimplification to say that through elimination of wildfire alone, southern pine lands would return to a highly productive state. Yet, the seeding proclivities and fire resistance qualities of the southern pines are such as to make the above statement nearly true.

The existing stands, vast in their aggregate, and all of which have been burned one or more times, are dense, understocked, or nonproductive in direct relation to the fire history of each. Bad cutting practices have had their effect. Nevertheless, in spite of former widespread exploitation logging, one can find near endless examples of fine naturally regenerated second-growth stands on those abused lands where it so happened that woods fires were infrequent. Fire control intensity has been and will continue to be the most decisive factor in determining the extent and quality of timber stands available to the landowner or silviculturist on which to apply good management practices.

Prior to the CCC program in 1933, only fractional and scattered parts of this area received any organized protection. Some States had not then created even a nucleus of a protective organization.

In 1932, 41,391,690 acres were under protection of some degree. On those protected areas occurred 21,776 fires which burned 2,342,960 acres.

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[1] Paper presented at the annual meeting, Society of American Foresters, Biloxi, Miss., December 14, 1951.

On the 129,000,000 acres of unprotected forest land, there occurred (incomplete) 101,277 fires, burning 38,732,560 acres.

I do not wish to burden you with statistics. Certain figures, however, are essential in producing a picture of the changes which have occurred and the present situation:

	Protected area		*Unprotected area burned*	*Total burned*
	Total	*Burned*		
1932	41,391,690	2,342,960	38,732,560	41,075,520
1940	84,603,000	1,704,251	27,383,649	29,087,900
1945	96,647,000	1,354,741	13,986,527	15,341,268
1950	133,600,000	2,754,522	10,920,155	13,674,677

In other words, the area under protection has more than trebled. The area burned annually has been reduced by two-thirds.

While we are considering progress, a misconception of the existing southern fire problem could be formed if at this point I did not underscore the fact that in 1950 there remained 47,000,000 acres of unprotected forest land, on which occurred 97,395 fires, burning 10,920,155 acres.

The previously quoted figures do tell a story of steady and outstanding progress in fire control effectiveness. The question follows: What were the developments contributing most to those effects?

First, within the last few years there has been a tremendous reversal in the minds and viewpoints of the general public towards woods fires. Call it Fire Prevention, I&E, or what; the fact is that across the South, from a former combination of actual belief in woods burning and mass indifference, the business, civic, and political leaders, newspaper editors, folks in the small towns, and many rural residents have gained an understanding of the limitations imposed upon the general economy by past woods burning.

There now is widespread realization that the southern timberlands can produce so bountifully and steadily as to create large income to landowners, and the wages and business transactions which would go with the expanded wood-using industries can rise to where these industries would assume a major and stable role among all other contributors to southern economic health.

This change in public attitude is the fruit of: (a) The unremitting and extensive educational campaigns conducted by forestry and agricultural agencies and by the more farseeing and better led wood-using industries; and (b) the power of the dollar—the recent vigorous growth of all types of wood-using industries. This growth is illustrated by the southern pulp industry which during the last decade has expanded to 61 mills with 7 more building, and which now is consuming 12,250,000 cords per year or 60 percent of all pulp produced in this Nation.

This demand for stumpage at good prices at all points in the South, coupled with the creation of significant woods working pay rolls, has given concrete meaning to the foresters' story that tree growth is too valuable to destroy and has had much to do with the development of positive opposition to woods burning by such a large part of the public. Again, this is progress only. We still have a long way to go before that remnant of the population still prone to deliberate and careless woods burning is educated to where fire occurrences will approach reasonable numbers.

Under the best of prevention conditions, the southern woods will continue to have fires. As protection becomes more effective and fires less frequent, a marked change occurs in the nature and density of ground cover and behavior and intensity of fires. In frequently burned woods, the amount of fuel is of course relatively light, and fires are not too difficult to supprress. With protection, our fuels accumulate, young growth develops and fires tend to crown.

Down here we must contend with a lush growth and rapid development of fuels. They are flash fuels, will burn within a few hours after a heavy rain, and will burn at any time of the year. Our fires spread fast and before the high winter winds, will run and spread with extreme rapidity. Fire spread is so fast and the amounts of control line to be built pyramid so rapidly, that even with great reservoirs of trained manpower quickly available during CCC days, and the then much lighter fuels, we learned that manpower with hand tools could not do an acceptable suppression job.

After the close of CCC, the southern fire men soon learned that the combination of time required to gather and place manpower on the fire line, the rapid advance of the fires, the increased difficulty of building a control line, and the peak numbers of simultaneous fires in an operating area, added up to defeat.

The magnitude of our fire problems magnified the inherent weaknesses and limitations of old suppression methods and had the fortunate effect of supplying the impetus needed to rapidly develop and adopt more effective methods and facilities.

In addition to the major change in general public opinion toward woods burning and fire prevention and the marketability of woods products at good prices accompanying the expansion of southern industries, the following have been significant developments.

1. Of crucial importance was the increase in State fire budgets from $2,258,214 in 1941, to $4,898,000 in 1946, and $10,262,000 in 1951. Those increases reflect, of course, the development of more effective presentation of the value of fire control to the people and the State legislatures.

2. We have expanded the use of fire danger meters to guide the daily intensity of observation coverage and the activation and strength of key suppression forces.

3. Most protective organizations have developed effective radio networks that make direct communication possible between all levels from the chief to the crew leaders. This has resulted in a speed of action and degree of coordination between segments of organization not otherwise obtainable.

4. The most outstanding and revolutionary development has been in the field of powered fire line equipment. In the southern States, State foresters, national forests, and industrial landowners have acquired more than 1,300 mechanized fire line units during the past 6 years. These units, designed to meet specific performance requirements, are divided into four general weight or size classes, each with alternate designs to conform to the requirements presented by topography, soils, types and density of ground cover, and rates of fire spread found in the different areas and timber types.

These units, many of which require a crew of only 3 or 4 men, have a productive capacity equivalent to 40 or more trained and fresh men;

they can keep going day or night and handle a number of fires in one day. The relative effectiveness of equipment over straight manpower increases by the hour. In our climate at least, the exertions incident to building fire line by hand wears men out rapidly and their productive rate begins falling. Equipment fire control operations require less physical effort on the part of supporting manpower, and replacement of those crew members is a relatively simple problem.

One key to their outstanding success is that, with radio communication and fast transports, these units can be spotted at strategic points, and they start line building while fires are still small and usually have a fire suppressed in less than the time required to simply assemble a sufficiently strong manpower crew.

Another key is that the high mobility of these radio-controlled mechanized units make it possible in a short time to draw from a wide area and concentrate on a dangerous situation the numbers of these powerful forces that the situation may demand. Studies have revealed that under parallel situations, the total cost of mechanized suppression is about one-quarter of the cost of hand tool suppression.

Of even greater importance, the area burned, and consequently the amount of fire damage, on the equipment-fought fires is about 20 percent of that which we suffer under the hand tool control methods.

In the past, during periods of high burning conditions, fires—even with more than 1,000 men on them—reached major sizes and burned for days. In areas properly equipped with machines, no fire situation has developed which could not be controlled in a matter of hours.

5. The development of prescribed burning or the use of fire as a timber management tool has resulted in outstanding contributions to the know-how and quality of fire control operations. Nevertheless, it must be emphasized that properly conceived prescribed burning is primarily for silvicultural effects.

By some, this activity is misconstrued to include the old practice of "light burning" or the burning off of an area simply to prevent a later wildfire from running through it. Prescribed burning *does* lessen the probability of a disastrous fire. On a large and managed area normal use of fire for silvicultural objectives results in the removal of dangerous fuels from a number of separate blocks thereby increasing the probability of a bad fire running into one of these blocks where it can be stopped quickly. Its one direct protective use is in the breaking up of extensive bodies of dangerous fuels by burning a new pattern of strips annually at various strategic locations, with a technique that inflicts only minor damage to the commercial stems and continues those areas in timber production.

A more significant contribution is what the execution of prescribed burning has taught the fire man about the characteristics and behavior of fire in our fuels. Wildfires usually are suppressed under conditions of rush and excitement. There then is but limited time or opportunity to calmly study the many vagaries of fire.

When using fire as a planned work job, even the old timers exhibit nervousness during their early experiences. However, as time passes and they work steadily under conditions of calmness, they begin to observe and learn fire's more intimate behavior characteristics. They learn the ways fire actions can be predicted and directed. In time they gain a feeling

of confidence and surety of their ability to master fire. Out of this work has come a corps of men and attack methods having definitely superior effectiveness in the suppression of wildfires.

6. More effective training is being given through cooperative programs by the protection agencies. The quality of execution of any job is set by the quality of training given the men who are to do it. This fact assumes greater importance in the actions of suppressing live and moving fire where the penalties for delays or substandard performance can be so costly. One of the two more valuable developments has been the combined field training programs attended by key men from all protection agencies within a State and in which each organization takes leading parts. This approach results in rapid exchange of the lessons each organization has drawn from its experiences, a broader source of minds to consider each other's problems, and more uniform operating methods by agencies which frequently have to work together on the same fires. The second development has been more and more use of actual fires as models on which to demonstrate both good and bad practices and work out improvement suggestions.

The critiques which follow these "live ammunition" actions have demonstrated that these training lessons are more vivid, clear, and lasting than those using classrooms or simulated fires only.

Improved Stick-on Azimuth Circles

The Rocky Mountain Region of the U. S. Forest Service has for many years had a problem in the production of radial circle maps for fire control use. The azimuth circles were first drawn by hand, which was inordinately time-consuming even when done by skilled draftsmen.

In the mid-thirties the California Region developed a hand instrument for printing protractors on base maps. Known as the California Printer, it speeded up the process of adding radial circles; but great care had to be taken to get the placement and orientation right, and the imprints lacked the sharp definition that is desirable. The instrument is still used in many areas, however.

Attempts were also made to fasten printed radial circles to maps with adhesive. One of the first commercial products in this field, the "Glassine" radial circle, was printed on opaque paper. The fastening agent usually deteriorated in a few months, however, and the circles buckled and fell off. Another product, the "Visitype" protractor, was tried next. It used a paraffin-base adhesive, which was only a slight improvement. We then contacted the manufacturer, explained our difficulties, and eventually received for test purposes some improved Visitype protractors printed on clear cellulose acetate, with resinous adhesive backing.

The acetate protractors were mounted on a test map, which was then placed in use in a sunny location inside the cab of Squaw Mountain Lookout, on the Arapaho National Forest, at an elevation of 11,300 feet. Thirteen months later the circles were still in excellent condition, with no buckling, wrinkles, or fading, and without the slightest appearance of adhesive failure. During that time the map had been subjected to temperature variations of from 90° above to 30° below zero, and relative humidities from 10 to 90 percent.

It is our opinion that the new Visitype radial circles, printed on clear acetate and with a resinous adhesive backing, can be used to great advantage in the preparation of fire control radial maps. The product is inexpensive, can be mounted without tools or special equipment, and may be obtained in quantity.—Wilfred S. Davis, *Forester, Region 2, U. S. Forest Service.*

BUMPER SERVES AS CONTAINER FOR TORCH FLUID

D. A. Anderson
Head, Research & Education Department, Texas Forest Service

A novel container for holding a reserve supply of fuel oil for backfiring torches is being put to increasing use by the Texas Forest Service. It is actually the front bumper of fire fighting vehicles (fig. 1). The unit, which will hold about 2½ gallons, was developed by J. O. Burnside and M. S. Lawrence of the Fire Control Department.

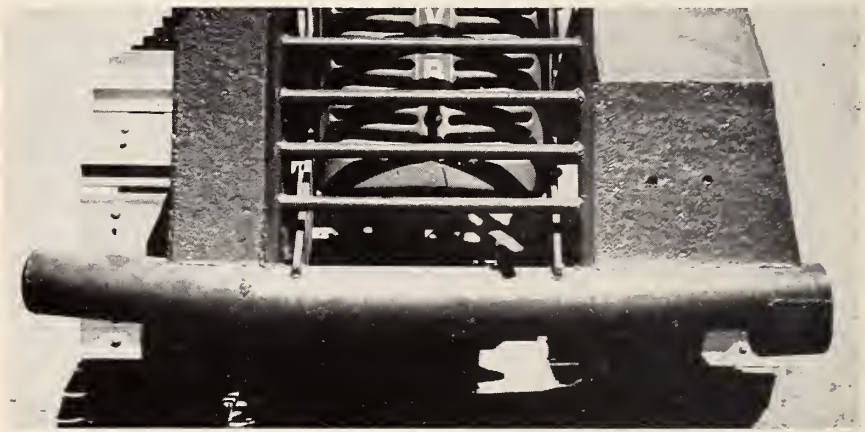

Figure 1.—Tractor bumper made to serve as a container for back-firing torch fluid.

The bumper is made from 4-inch, round, steel water pipe. For the tractor shown, a piece of pipe 57 inches in length was cut one-half through at a point 16 inches from each end. Each end was heated and bent back a distance of 4½ inches and welded electrically. One end of the pipe was capped with a piece of ¼-inch flat iron and welded. At the other end of the bottom half of the first 4½ inches was removed. Then, a disk of ¼-inch flat iron, which had previously been threaded for a ⅜-inch pipe, was welded as shown in figure 2.

To each side of the 4½-inch section removed from the pipe, there was welded a 2- by 4½-inch piece of flat iron, this being in turn welded back to the original cut on the bumper as pictured. Thus, the end of the pipe was given an oval shape to provide a place in which a valve could be installed and would be protected from damage.

A ¾-inch gas valve with stem cock was inserted at the bottom end of the pipe to serve as an outlet for the fire torch fluid.

For the intake point, a hole was cut in the top near the center of the pipe in which was inserted and welded a piece of threaded ¾-inch pipe, 1¾ inches long. A 2-inch piece of flat iron was welded to a ¾-inch pipe cap that served as a cover for the intake point (fig. 2).

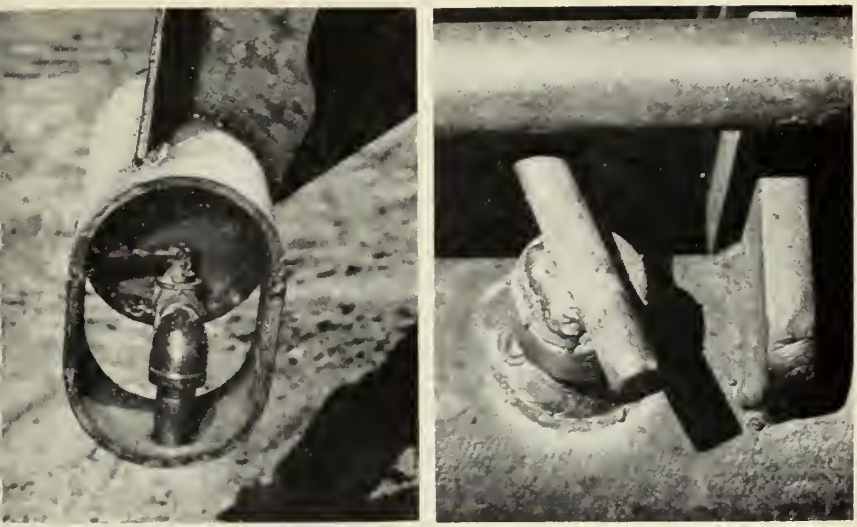

FIGURE 2.—*Left,* End of bumper container showing valve installed. *Right,* Intake with pipe cap in place.

Thomas Jefferson on Forest Fires

The following is quoted from a letter by Thomas Jefferson to John Adams written at Monticello, dated May 27, 1813:

"You ask if the usage of hunting in circles has ever been known among any of our tribes of Indians? It has been practised by them all; and is to this day, by those still remote from the settlements of the whites. But their numbers not enabling them, like Genghis Khan's seven hundred thousand, to form themselves into circles of one hundred miles diameter, they make their circle by firing the leaves fallen on the ground, which gradually forcing the animals to a centre, they there slaughter them with arrows, darts, and other missiles. This is called fire hunting, and has been practised in this State within my time, by the white inhabitants. This is the most probable cause of the origin and extension of the vast prairies in the western country, where the grass having been of extraordinary luxuriance, has made a conflagration sufficient to kill even the old as well as the young timber."—From "The Writings of Thomas Jefferson," edited by H. A. Washington.

CONVENIENT MAP CARRIER FOR FIRE TRUCKS

William E. Towell
Chief of Fire Control, Missouri Conservation Commission

Harold J. Ruetz, Forest Assistant on the Meramec Fire Protection District, has developed a simple but convenient map carrier for his pickup. The carrier is a small metal frame to hold regular window shade rollers. [1] The frame is open at the bottom and fastened to the ceiling of the pickup cab; one end is held in place with screws so that the rollers can be easily removed. Maps printed on cloth can be stapled or glued direct to the rollers. Paper maps are mounted on unbleached muslin with wallpaper paste.

To keep down the size of the map carrier, Ruetz has used three rollers, with a one-half inch to the mile scale map of each of the three counties in his district (fig. 1). The same type frame could be used for more maps, or wide maps if desired, the limiting factor being the width of the cab. This map carrier is ideally suited for the district forester or ranger who needs to have fire map, ownership map, type map, and various others at his fingertips when away from headquarters. It is extremely handy for the fire crew leader who uses only one map frequently.

[1] Similar use of shade rollers reported by Ed. J. Smithburg in April 1949 issue of Fire Control Notes.

Figure 1.—Map carrier with three rollers.

USE OF AERIAL PHOTOS ON BOARDMAN RIDGE FIRE

K. A. Cuff, *Mendocino National Forest,* and
R. H. Neuns, *California Forest and Range Experiment Station* [1]

Aerial photographs proved their worth on the Boardman Ridge fire, Mendocino National Forest, last summer. This fire, started September 11 by a careless camper, roared over 6,670 acres of rough terrain covered by mature timber, reproduction, brush, and woodland. When finally corralled, the fire had a 17-mile perimeter that wound across elevations from 2,000 to 7,000 feet above sea level. Properly used, aerial photos saved time and trouble on the job.

Scouting the fire, we found the photos great time-savers in giving the plans chief and fire boss much detailed information. Using the pictures made it possible to prepare maps quickly by sketching from a plane, helicopter, or vantage points on the ground. A map made with the help of a helicopter, for example, took about 20 minutes to complete and showed the perimeter, hot areas, spot fires, open cat lines, and safety lines. These maps were accurate, too. The last rough draft indicated an area of 6,700 acres, as compared to 6,670 acres on the final map prepared for statistical use.

The speed with which information could be obtained was especially valuable when quick decisions had to be made on the location of fire lines. In one sector the fire jumped its line and made necessary an immediate selection of a new location. At first it seemed that the best action was to backfire from a safety line, increasing the acreage considerably. But a few seconds of careful photo interpretation showed a hand line could be built readily in one location. The time from determination of this line until it was completed and backfired was slightly more than an hour. The line held and saved 1,500 acres.

Good photo interpretation can readily determine for the plans chief information on cover types and terrain that will help in ordering kinds of tools to be used in building line, computing rates of line construction, and picking access routes. Even though areas are hidden by smoke, vitally needed information—fuel types, possible control lines, slope of ground, dropping areas, helicopter ports, and safe routes of escape—can be determined in a hurry from aerial photos.

Experience on the Boardman Ridge fire, however, demonstrated that a special effort is necessary to make the most of the photographs' potentialities. One requirement is good coordination and use of photo information between Intelligence, line overhead, and other overhead. Another is good interpretation, an exacting task if all possible information is to be gleaned from the pictures. It was observed that many men who can see stereoscopically do not seem able to see detail. The ability to supply detailed information is the photo's main asset. Giving a group of selected men intensive training in aerial-photo interpretation would make this useful tool much more effective and encourage its wider use in fire control jobs.

[1] The California Forest and Range Experiment Station is maintained by the Forest Service, U.S. Department of Agriculture, in cooperation with the University of California, Berkeley.

COOPERATIVE FIRE FIGHTING BY INDIANA SCHOOLS

Division of State and Private Forestry
Region 9, U. S. Forest Service

The work of the Division of Forestry, Indiana Conservation Department, in training high school students under the Forest Fighters Service was begun during the last war as part of the Civilian Defense Program. [1] This important work has continued up to the present time with no let-up in intensity. In addition to accomplishing a better fire record, the possibility of carrying and selling the gospel of fire prevention to tomorrow's citizens in realized.

Figure 1.—Presentation of safety plaque to Indiana Forest Fire Fighters Service. Left to right: Vernard Rice, District Fire Warden; Emmeran Tretter, District Fire Warden; Henry F. Schricker, Governor of Indiana; Joe De Young, Coordinator, FFFS; Joe Brishaber, Austin K. Easley, and L. E. Kern, District Fire Wardens.

In 1941 prior to the start of the program, 610 fires burned over 42,329 acres in southern Indiana, an average of nearly 70 acres per fire. Since then there has been a gradual reduction until in 1950, 235 fires burned over 3,880 acres or a little over 16 acres per fire. Of course various other factors have to be recognized, but there is no doubt that the high school training program is in part responsible for this improved record. Since the beginning of the program, 30,000 volunteer fire fighters have been trained. Four hundred and fifty-eight different crews consisting of

[1] See the September 1951 issue of American Forests for a more complete description of this work.

4,058 high school boys have spent 13,596 man-hours fighting forest fires, and 81 high schools have been presented with a merit award by the State in recognition of their assistance in fire suppression.

An important part of the training course has been the demonstration of safety, and safety precautions have been stressed in actual work on the fire line. This part of the training has paid off because the Forest Fire Fighters Service, under the direction of the Division of Forestry, has completed 10 years of work without an accident. For this achievement, the Forest Fire Fighters Service was awarded a plaque by the Hon. Henry F. Schricker, Governor of the State. The plaque was presented to Joe De Young, Coordinator of the program, and to the five district fire wardens in a brief ceremony at the 1951 Indiana State Fair (fig. 1).

Pilot Balloons for Marking Fires

The use of pilot balloons for marking fires discovered by patrol aircraft, to facilitate their location by ground men or smoke jumpers, has been suggested from several sources.

After looking into the records and discussing the problem with others, we found that there were several instances where such a marker would have been of help. We set up a test program comtemplating the use of weather balloons, which were reasonable in cost and easily obtained. We believed it would not be too difficult to arrange for inflation by a small cylinder of helium or hydrogen gas, after the balloon was clear of the airplane, if another more simple arrangement could not be devised.

We found that weather balloons could be obtained in 30-gram, 100-gram, and 300-gram sizes. The 30-gram size inflates to approximately 2 feet in diameter, and costs about 20 cents each. The 100-gram size inflates to approximately 3 feet in diameter, and costs about 50 cents. The 300-gram size inflates to 4 or 5 feet, and costs about $1.60. All sizes are much more resistant to puncture if inflated to only about 2/3 size. The 30-gram balloons may be obtained in several colors, and the 100-gram balloons in white, red, black, and yellow. The 300-gram size was available only in white.

Several balloons were inflated, attached to anchor strings, and their action observed. It was found that with only a minimum of air movement (less than 4 m.p.h.) the balloon would drift until it rubbed on the tops of any timber. The balloons lasted only a short time until punctured by weeds or tree limbs.

Personnel who observed the behavior of the pilot balloons were of the opinion that balloons large enough to be used as markers, and strong enough to withstand puncture, would be too expensive. A balloon of 4 or 5 feet diameter would be required to provide enough lift to stay aloft when anchored near the fire on days with very little or no wind movement.

It appears that there are better possibilities in plane-to-ground radio and in working out methods of signalling the fire location from the patrol plane. This has been done successfully on several occasions in air-ground detection units now in operation.

The project is now discontinued until further information or a new method becomes available.—Aerial Equipment Development Center, *U. S. Forest Service, Missoula, Mont.*

POWER DEVICE FOR CLEANING STEEL BOOSTER TANKS

J. R. McLees

Fire Control Engineer, South Carolina State Commission of Forestry

The Branch of Forest Fire Control, S. C. State Commission of Forestry, is using as standard equipment ranger trucks outfitted with a set of three interconnected booster tanks. The cross tank back of the truck cab is 14 inches deep, 18 inches wide, and 48 inches long. Radio equipment in a weatherproof box is mounted on this tank. The two other tanks, located on the left and right side of truck bed, are each 14 inches deep, 12 inches wide, and 60 inches long. These side tanks serve also as seats for fire fighters. The tanks are made from 14-gage blue annealed steel sheets. All joints and connections are electric-welded.

Because rust and scale accumulated on the interiors of the tanks, annual maintenance was costly until the machine shown in figure 1 was devel-

FIGURE 1.—Set of booster tanks being cleaned.

oped. This cleaning device will accommodate the set of three tanks simultaneously. The tanks are clamped at the ends in angle-iron frames and are held there by stay bolts on two sides. The end clamps, one to each tank, have sprockets attached and are chain driven from a countershaft powered by a 1-hp. electric motor and connected to the countershaft by a rubber V-belt transmission. The individual drive from the countershaft is by roller chain and sprockets.

The tanks are filled to approximately one-eighth of their depth with ¾-inch sharp crushed stone, and then water is added to one-fourth of the tank depth. When the tanks are turned at 55 r.p.m. for a period of 8 hours, the scouring action of the tumbling stone will thoroughly clean the interiors. The only hand cleaning required is the face of the two baffles in each tank. These are accessible through three handholes, the cover plates of which show clearly in figure 1.

After a thorough cleaning and drying, the interiors of all tanks are treated with a special asphaltic tank-coating compound. If the tanks are allowed to go too long without treatment, the stone and water tumbling may have to continue for as long as 16 hours. It has been found that tanks of this type when properly cleaned and treated can be kept in service for 3 years without retreatment.

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TOOL GRINDING TABLE

ALVIN EDWARDS
Warehouse Clerk, Mendocino National Forest

The tremendous job of reconditioning hand tools in fire camps and in the warehouse following large fires has led to the development of the following method of doing the job.

An ordinary automobile body and fender disk sander with a 8- or 9-inch flexible phenol abrasive disk, #24 or #36 grit, is used for grinding. This will grind a smooth, sharp edge on any tool very quickly and does not heat the metal enough to burn it as does the ordinary grinding stone.

Tools are held solid and in position on a table with holding jigs for all of the types of sharp tools ordinarily used in fighting fire (figs. 1 and 2). The disk sander is held by the operator. This enables the operator to look directly at the side of the tool he is sharpening. By so doing, he can better shape the tool (fig. 3). As for safety, all material thrown from the blade or the disk is directed down by the disk so there is no danger of getting particles in the eye.

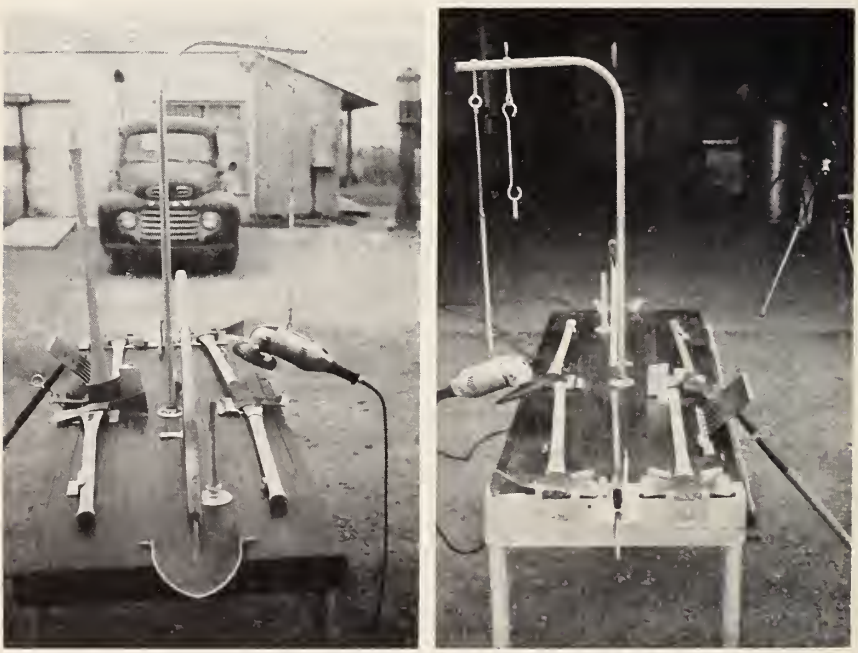


FIGURE 1.—Tool grinding table: *Left,* Tools in position for grinding; *Right,* jigs for holding tools from which handles are to be removed.

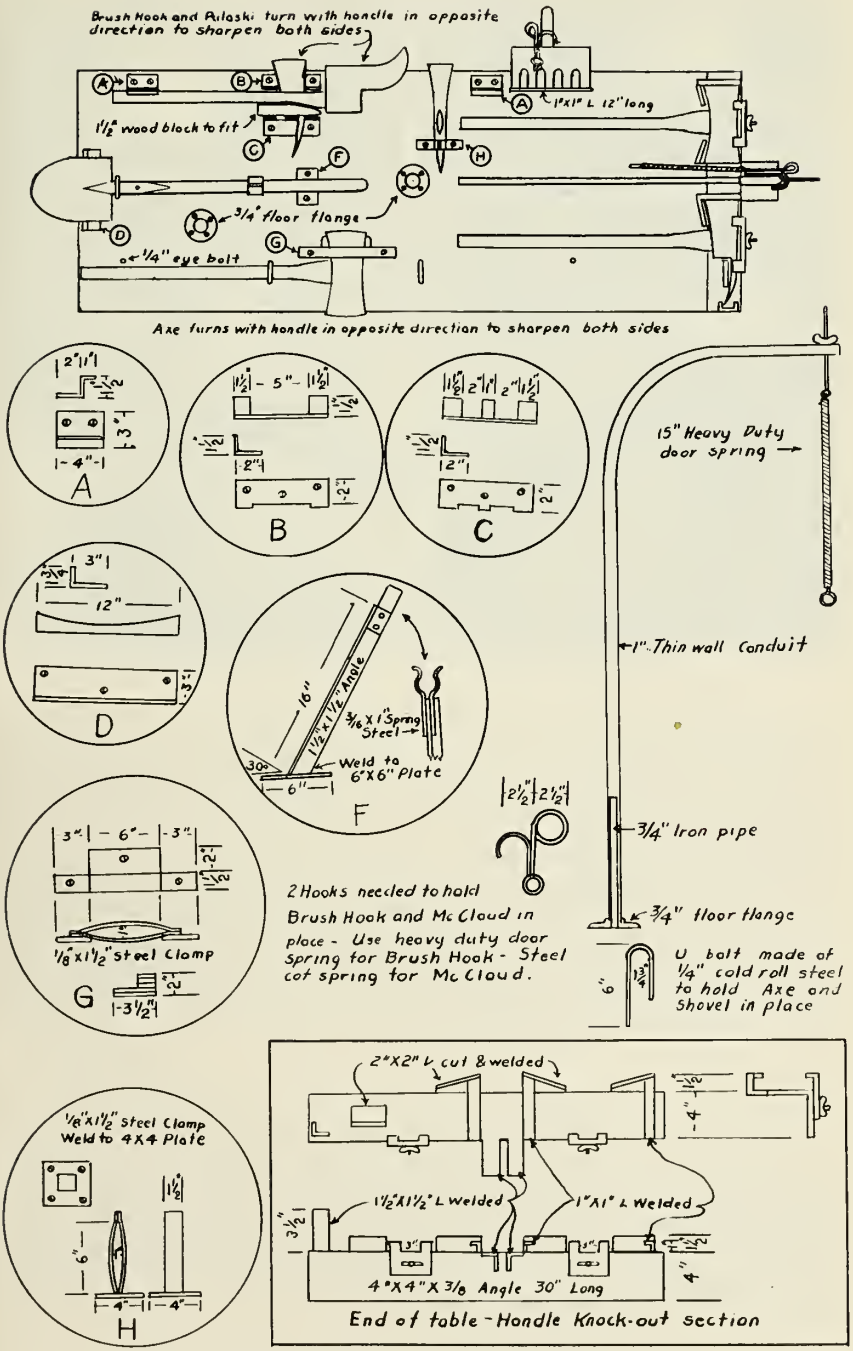


FIGURE 2.—Details of tool grinding table.

FIGURE 3.—Grinding ax and Pulaski blades.

Jigs were also made to hold tools in place for drilling and knocking out handles which are to be replaced. New handles are placed in a vise and shaped to fit the eye of the tool by using the same grinder with a #16 grit disk.

The table and grinding unit were used on two large fires and at the forest warehouse during the 1951 season. It is estimated that 50 percent of labor time is saved over the old method of grinding, as well as a saving in that tools are better sharpened and blades are not burned. Two men with two grinding units may work on the same table with little interference.

The fender and body sander may be used with commercial electric power, or with a small portable generator.

Starting Cables for Chain Saws

Small cables for starting cords on chain saws break frequently at the handle. The most often used method of repairing is to tie a knot in the cable to prevent it from pulling back through the handle. The result is further breaks in the cable at the knot.

By cutting a small piece off a #12 nicopress sleeve, slipping it over the end of the cable, and compressing with a nicopress tool. the broken cable can be prevented from slipping through the handle and will last as long as the original factory job.—KENNETH W. WILSON, *Wenatchee National Forest.*

SMOKEY—AT POINT OF SALE

CLINT DAVIS
Director, Cooperative Forest Fire Prevention Campaign[1]

Ranger Earl F. Sullaway of the McCloud District, Shasta National Forest in California, put me on the spot recently. He sent in a clipping from his local newspaper which told an interesting story about how Smokey Bear had directly prevented a forest fire.

It seems that a party of campers from San Francisco had been spending the week end fishing on the McCloud River, camping at a nearby recreational area. On their way home they stopped in McCloud to make some purchases. In the store window was one of the posters of Smokey Bear and the message, "You Can Stop This Shameful Waste!" Looking at the poster thoughtfully, one of the members of the party turned to the other and said, "Are you sure we put out our campfire?" The other fisherman was not sure, so together they went back to where they had been camping.

Sure enough, in spite of the coffee grounds and dishwater which had been dumped on their fire before leaving, there were still hot coals burning, and at one corner the fire had crept away and was beginning to burn in the thick pine duff which had not been cleared away from the campfire.

This time they put their fire out right, and on their way out again stopped in at the Ranger Station and frankly told Ranger Sullaway exactly what had happened. The newspaper quoted Ranger Sullaway as saying, "If that fire had gotten away with the burning condition which we have had during the past two or three weeks, it could have very easily made such a start before being discovered that it would have destroyed much valuable timber and blackened a great many acres. Smokey Bear sure did his part in keeping California Green and Golden."

That was a very interesting article. As a matter of fact, it was the first case history that documented Smokey Bear as actually preventing a forest fire. I knew it would interest our friends at The Advertising Council, the organization which has so generously sponsored and guided our efforts in the Cooperative Forest Fire Prevention Campaign for the past 10 years. So at the first opportunity I showed it to Ted Repplier, President of The Advertising Council. Repplier read the article with interest. There was an enthusiastic gleam in his eyes when he had finished. "By gosh," he exclaimed, "you foresters are finally beginning to do point-of-sale merchandising."

Well, that put me on the spot. And it was all Ranger Sullaway's fault. You see, I thought the story was kind of cute, but with my limited knowledge of advertising lingo the pieces didn't quite fit together on this point-of-sale merchandising business. But Repplier is a kind and patient individual, and he spelled it out. He explained that, in the advertising business, when a manufacturer decides to introduce a new product Nation-wide, the first objective is to develop public recognition of the product. Let's say the product is Cancan Pork and Beans. Public acceptance of this product must first be built around brand recognition, so the advertising

[1] Sponsored by State Foresters and U. S. Forest Service. A brief history of the campaign, reprinted from the April 1951 issue of American Forests, may be obtained from the editor of Fire Control Notes.

agency in charge of introducing this new product decides on the media to be used.

The agency calls in an artist, the idea boys, copy writers, and they come up with several pieces of art, develop a gimmick in the advertising, usually something in the way of a symbol that will forever-after be associated with the product. Say, in this case, our symbol is an animated bean on which the artist with full liberty depicts a broad smiling face, chubby legs and arms, and a well-filled tummy. His general appearance seems to exude "Yum, Yum!" Usually several different channels of advertising are selected and the promotion is then kicked off. Soon afterward, when you board a streetcar or bus you will subconsciously begin noticing a colorful car card showing a steaming, appetizing plate of Cancan's Pork and Beans. Along side the mouth-watering dish stands our friend "Beanie" inviting you to try his tasty treat after the day's toil. Perhaps it doesn't make much of an impression at first, but it registers on the subconscious mind.

That evening when you get home and start thumbing through your favorite magazine, you run across a doubletruck spread (this is advertising lingo for two full pages of advertisement facing each other) and there is Cancan's steaming, tantalizing plate of pork and beans. Our little friend Beanie is sure to be around some place in the ad with that Yum Yum expression. Perhaps a week later you hear a commercial on the radio which tells you the virtues of Cancan's Pork and Beans. The average person goes through all of this and rarely ever gets the urge to drop what he is doing and rush right out and buy a can. But in that subconscious mind there is building up a little reaction that says, "Boy, if I ever buy pork and beans, I'll take Beanie's advice and try Cancan's." That, according to Repplier, is building up public acceptance for brand recognition.

Up to this point, there seemed nothing very different in this line of thinking than what was being done in the CFFP campaign. Car cards have extolled the importance of preventing "This Shameful Waste." Radio has hammered home the need for each individual to use care in preventing forest fires; fire rules cards have graphically portrayed how each individual could take step-by-step measures to prevent his acts from causing a fire; the tag line slogan on every poster, "Remember—Only *You* Can Prevent Forest Fires!", definitely personalized the job.

I pointed this out to Repplier and asked how his mythical Cancan Pork and Beans could do any better selling job than we have to date on forest fire prevention. "Oh, but that is where point-of-sale merchandising comes in," he exclaimed. After the business firms develop public acceptance and brand recognition, they concentrate on reaching the potential customer at the point where he is most apt to be exposed to the product. In the case of pork and beans, naturally, it would be in the grocery store; a large poster on the front of the store, a colorful display of the product neatly stacked where the customer can't miss it. This has all been arranged by representatives of the manufacturer. A big red arrow points to the stack and says, "Here it is!" And without thinking, you rely on that subconscious force and before you know it you have three cans of Cancan Pork and Beans in the market basket. The manufacturer, following the strategy planned by his advertising agency, had cleverly channeled his advertising until the customer was finally confronted with the product and a forceful invitation to purchase same. That, according to Repplier, is point-of-sale merchandising, exactly the type of psychological reaction that entered into

the case of the two fishermen that saw the Smokey poster in a store window in McCloud, California. "The only improvement on that particular case," said Repplier, "would have been for the customer to have encountered a poster right in the campground." But even so, it's an excellent example of point-of-sale merchandising. In other words, impressing our client, the public, with a fire prevention message *when* he is right in the woods and *his chance of preventing a forest fire is greatest.*

Repplier pointed out that progress in reducing man-caused forest fires during the next few years will depend largely on how efficient we are in our point-of-sale merchandising. He feels that this is the weakest link in our over-all fire prevention program. Pointing out his own experience on a trip West last summer, he said that he stopped in numerous campgrounds and picnic areas of National Forests and State Parks, and other centers of outdoor activity and found some excellent examples of point-of-sale merchandising—a fire prevention message at a registration booth, or a poster mounted close by a camping spot (fig. 1). But generally, many of the areas that he visited, private and public alike, were weak in this important phase of the prevention sales job. A live-wire merchandiser would never pass up these sure-fire sales opportunities.

With a better understanding of the importance of point-of-sales merchandising on my own part, I tried to analyze some of our experiences in the past few years. Some organizations have been doing an outstanding job on point-of-sale contacts: The Virginia Forest Service, with its metal highway signs, and a Smokey Bear card reminding the public at every roadside picnic ground; Idaho, with its huge signs painted on the highways; California, with display cards tacked on the back of car stalls at tourist courts, and State patrolmen handing all entering motorists a rules card with Smokey's message. I imagine that numbers of New York tourists who first met Smokey on the subways of that city were reminded of many of his messages when they were handed a card with this familiar figure on it as they entered the State of California. Ours is a Nation of travelers and it is important to channel our messages so that the public will recognize their importance a long way from home.

Often it is fairly easy to localize Smokey and his message in order to capitalize on the national recognition already developed for this "million-dollar" character. For example, the South Carolina Commission of Forestry feels that selling the local people on the importance of saving the little trees through the preventing of grass fires is a most important appeal. They have developed a special poster, showing Smokey on his knees pointing to little seedlings that are destroyed when a grass fire, usually considered harmless, is allowed to burn across thinly stocked areas. The Texas Forest Service has developed a colorful and attractive folder which they mail to farmers and others in rural areas. The folder capitalizes on the Smokey theme by showing the two little cubs, the same designs that were used on the fire rules poster last year, crushing out cigarettes and drowning campfires.

The Keep Idaho Green Committee used a combination of its localized character "Guberif" (firebug spelled backwards) as the villain with Smokey chasing him down. A recent report from Idaho states, "Although a new character, GUBERIF, was introduced into the fire prevention program, the Keep Idaho Green Committee did not neglect the great potential of our friend, Smokey the Bear. In contrast, this peace-loving character and

FIGURE 1.—This is a 1952 poster, designed for point-of-sale use. It shows how to prevent forest fires while the basic poster, on back cover, is designed to develop awareness of the need to do something about forest fires.

the culprit, the Guberif, formed an ideal team which depicted the hero and the villain. It is the Committee's belief that the Guberif idea has somewhat localized our prevention program, thereby creating a fine, wholesome interest in the preservation of our natural resources." Up in Washington State, home of the Keep Green movement, the Keep Washington Green campaign developed an interesting skit for an important

Forest Festival Pageant. Smokey, one of the officials dressed in a bear skin, ranger's hat and dungarees, was constantly on the chase of the Fire Fiend. Undoubtedly there have been many other similar uses localizing our national fire prevention character. I hope to hear about them.

Recognizing the value of such localized use, I can't help but recall some of the many occasions where excellent opportunities were overlooked. Last summer, I had lunch with a ranger in a small tourist town on the Transcontinental Highway. Ninety percent of the community's livelihood was gained from tourists stopping at motor courts, cafes, and novelty shops enroute to California. For a six-block area tourist cars were parked solidly along the curbs, yet while browsing around the various shops before lunch time I was rather surprised in not seeing a single poster with a forest fire prevention message. Posters were not taboo in the stores, because quite a few were displayed in the interest of Savings Bonds, Armed Force Enlistment, and other programs.

At lunch the ranger and I noticed the headline on a newspaper being read at the next table. It reported several serious forest fires in California, 150 miles away. In discussing the fire situation in California, I remarked to the ranger that I was rather surprised not to see a single fire prevention poster in the various stores which I had visited in this little tourist center. He very proudly advised me that there had been only one forest fire on his district in the past 3 years and that it was considered practically a fire-proof forest. There wasn't much need in arguing against a record of that kind, so we passed the subject up.

But now, since this point-of-sale business has come up, I realize that we were overlooking a wonderful opportunity. Here was a spot where thousands of tourists, going into California, could be conditioned for a fire prevention sale. This was an excellent example of the need for teamwork in the prevention job. In many places where fire danger admittedly is not serious it may still be highly important, from the standpoint of conditioning the public, to put Smokey Bear to work. These factors are worth considering in the development of local forest fire prevention plans.

The Nation-wide campaign will continue developing mass appreciation for the need to prevent forest fires. American business and industry will back it in 1952 by contributing around 6 million dollars worth of advertising time and space to help us do the job. Many new aids will be introduced. One highlight is bound to be the song, "Smokey The Bear," now being groomed for release by a nationally known music publishing house. The music and lyrics have already been completed and they are considered very catchy and intriguing. Several recording companies are already under contract to release the number early in the summer. It won't be long before the American public will be hearing a little ditty which opens like this, "With a ranger's hat and shovel and a pair of dungarees, you will find him in the forest always sniffin' at the breeze. People stop and pay attention when he tells them to be aware, because everybody knows that he's the fire preventin' bear."

In addition, posters and car cards, radio and TV messages this year will extol Smokey's appeal—"This Shameful Waste Weakens America!" There will be a big national play all right. But what will it all buy? How many fires will Smokey actually prevent?

That, it appears to me, depends in very large measure, on the readers of this little article—on you men, privately or publicly employed, who find

the problem of forest fire prevention right on your own doorsteps, so to speak—and on how Smokey Bear is put to work on a point-of-sales basis.

And as for Ranger Sullaway, "I'm much obliged to you for putting me on the spot!"

Bottle Gas Heater Installations for Lookout Cabs

Gas burning space heater installations with small bottle gas containers are being used for heating lookout tower cabs on the Lower Michigan, and are found to be highly satisfactory. These heaters have a 15,000 BTU output rating. They take up little floor space, even when allowing for safe clearance to the combustible cab lining. The burners are easily lit, burn free and clean, are readily controlled, and are practically fume free. About 20 pounds of bottle gas is used for heating for an average year.

The gas supply cylinders used by the Lower Michigan are those originally furnished with the propane gas backfiring torches. The cylinders, which are approximately 8 inches in diameter and 26 inches long, can be charged with 9½ pounds of gas. Filling at a bulk plant costs about 7½ cents per pound. The cylinders are hung in the center of the underside of the cab, to provide the best shaded position. The gas is piped through the floor to the space heater with ⅜-inch copper tubing. A manual regulating valve is required for the installation, and can be obtained from the bottle gas dealer. We believe that two cylinder installations would be desirable, to provide an adequate fuel supply at all times.

The cost of an installation will vary somewhat, but the cost of a typical installation with a single cylinder, as made on the Lower Michigan, is as follows, omitting the cost of labor, gas cylinder, and initial charging of gas:

1 Gas burning space heater	$13.23
2 Flare nuts	.24
1 Half union adaptor	.20
1 Regulator, obtained from bottle gas dealer	3.50
6 Feet, ⅜-inch copper tubing	1.20
Total	$18.37

Labor for the installation averaged 4 hours for 2 men, including transportation to and from the job.

Local distributors of bottle gas are generally able to furnish fuel supply tanks as a service to purchasers of their product. Of the various sizes of tanks available, the 20-pound tank lends itself to installation in a manner similar to the propane gas cylinder used by the Lower Michigan. The 20-pound tank is approximately 18 inches high and 12 inches in diameter (kettle shaped), and is equipped with handles for carrying and mounting. While a single tank may provide an adequate supply for a season's use, a 2-tank installation will no doubt be desirable. However, the distributor can be consulted in this regard. The current cost of 20-pound cylinders in the Milwaukee area is $2.10, which includes the loan of the tank. The cost of an installation using a commercial bottle gas tank should not vary appreciably from the installation made by the Lower Michigan.

These safety precautions, given by the Lower Michigan, should be followed for bottle gas heating installations made in lookout cabs:

1. Check local regulations and instructions governing the use of bottle gas.
2. Follow safety regulations governing installation of heating units.
3. Always light burner with a long taper.
4. If old propane gas cylinders are used, test safety release valves. Release valve pops off at 300-pound pressure. This pressure would be developed at about 130° to 135° F., with cylinder containing 9½ pounds of gas.
5. To avoid accidental discharge, containers of propane gas must not be filled above the specified capacity and should not be stored where temperatures are excessive. The capacity of a propane torch cylinder is 9½ pounds of gas. The net weight of the cylinder should be determined before filling to assure an excess of 9½ pounds is *not* put in the cylinder. Net weight of cylinder plus 9½ pounds of gas equals maximum gross weight after filling.
6. Test all connections thoroughly for leaks. This can be done with heavy soapsuds and a brush.
7. Close cylinder shut-off valve during periods of nonuse.—From "Give 'N Take," *Region 9, U. S. Forest Service.*

INFORMATION FOR CONTRIBUTORS

It is requested that all contributions be submitted in duplicate, typed double space, and with no paragraphs breaking over to the next page.

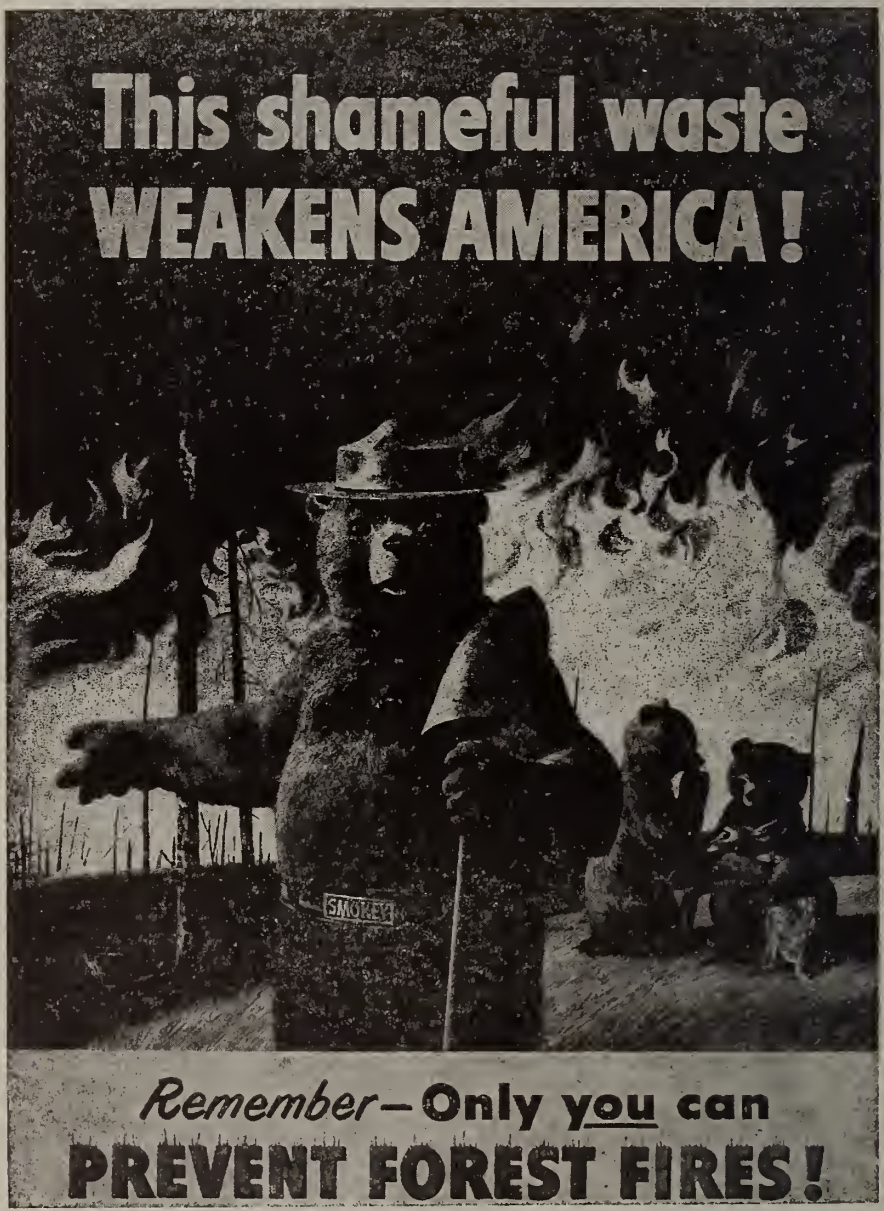
The title of the article should be typed in capitals at the top of the first page, and immediately underneath it should appear the author's name, position, and unit.

Any introductory or explanatory information should not be included in the body of the article, but should be stated in the letter of transmittal.

Illustrations, whether drawings or photographs, should have clear detail and tell a story. Only glossy prints are acceptable. Legends for illustrations should be typed in the manuscript immediately following the paragraph in which the illustration is first mentioned, the legend being separated from the text by lines both above and below. Illustrations should be labeled "figures" and numbered consecutively. All diagrams should be drawn with the type page proportions in mind, and lettered so as to permit reduction. In mailing, illustrations should be placed between cardboards held together with rubber bands. *Paper clips should never be used.*

When Forest Service photographs are submitted, the negative number should be indicated with the legend to aid in later identification of the illustrations. When pictures do not carry Forest Service numbers, the source of the picture should be given, so that the negative may be located if it is desired.

India ink line drawings will reproduce properly, but no prints (blackline prints or blueprints) will give clear reproduction. Please therefore submit well-drawn tracings instead of prints.


This shameful waste
WEAKENS AMERICA!
SMOKEY
Remember—Only you can
PREVENT FOREST FIRES!

VOL. 13 JULY 1952 NO. 3

FIRE CONTROL NOTES

A PERIODICAL DEVOTED TO THE TECHNIQUE OF FOREST FIRE CONTROL

FOREST SERVICE • U. S. DEPARTMENT OF AGRICULTURE

FORESTRY cannot restore the American heritage of natural resources if the appalling wastage by fire continues. This publication will serve as a channel through which creative developments in management and techniques may be communicated to and from every worker in the field of forest fire control.

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The value of this publication will be determined by what Federal, State, and other public agencies, and private companies and individuals contribute out of their experience and research. The types of articles and notes that will be published will deal with fire research or fire control management: Theory, relationships, prevention, equipment, detection, communication, transportation, cooperation, planning, organization, training, fire fighting, methods of reporting, and statistical systems. Space limitations require that articles be kept as brief as the nature of the subject matter will permit.

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Forest Service, Washington, D. C.

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CONTENTS

OPERATION REDSKIN

K. O. Wilson
Fire Control Officer, Region 3, U. S. Forest Service

Maps of Arizona and New Mexico are dotted with many and widely scattered Indian reservations. These range from the massive 11,000,000-acre Navajo Reservation, home of over 50,000 Navajos, to the tiny Havasupai Reservation in the depths of Havasu Canyon, a tributary to the Grand Canyon of the Colorado, which is home for less than 300 Havasupai Indians. Ruins of the dwellings of ancient tribes long since gone are common, and the entire Southwest is steeped in Indian lore and legend. Public opinion to the contrary, most of the tribes are no longer uncivilized savages. As a matter of fact, many of the younger Indians are well educated and several tribes can boast of a good sprinkling of college graduates. All very interesting, you say, and even educational, but how did this get into a fire control publication?

For several years the Forest Service in the Southwestern Region has been using Indian crews on fire suppression work. Some of these crews, whose homes are within the forest type, have been trained in fire work by the Indian Service. The Mescalero-Apache tribe in southern New Mexico and the Fort Apache and San Carlos tribes in east-central Arizona fall in this category. By contrast the Navajo and Hopi tribes of northern Arizona live well over one hundred miles from the nearest forested land, although they live in plain view of the forest-covered mountains in the distance.

But trained or untrained, these Southwestern Indians are peculiarly well adapted to fire suppression work. They are by nature outdoor people, skilled in the use of hand tools, exceptionally well disciplined, and possessing amazing endurance. In addition, the fire camp life which we normally think of as rigorous is oftentimes at a level or higher than that to which the average Indian is accustomed; and too, the very nature of suppression work is well suited to the Indians' likes. Another important factor is that they are almost fanatically home-loving individuals and very much dislike to be separated from their families for long periods. The long hours, short tenure, and relatively good pay characteristic of fire suppression work are made to order for these Indians.

During a serious fire bust in southern California in 1950, 2 organized 25-man crews of Hopis were dispatched by plane from Winslow, Ariz., to San Bernardino, Calif. (fig. 1). Their performance was so outstanding that they were called back on 3 subsequent fires in that season. During the disastrous 1951 season, 20 such crews were dispatched to California. At one time there were nearly 200 Indians from Arizona and New Mexico on fire suppression work in California. These were from 3 tribes: the previously mentioned Mescalero-Apache and Hopis and 3 crews from the Zuni tribe in west-central New Mexico.

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FIGURE 1.—*Top,* Region 3 organized Indian suppression crew boarding Air Force plane for out-of-region assignment. *Bottom,* Indian crew building line in heavy brush type in California.

The normal organized crew consists of 1 foreman, 2 strawbosses, and 22 line workers, all Indians. The size of the crews sometimes must be adjusted to fit the capacity of the planes in which they travel. It is general

practice to send a capable forest officer with each crew to handle time-keeping, feeding, transportation and liaison work.

Many of you have heard tales and read about the poverty-stricken, starving Southwestern Indians. While some of these stories paint the picture somewhat darker than is actually the case, it is true that most of these tribes are very poor by our standards. Their wants are few, and fortunately so, because job opportunities are not plentiful in this vast, thinly populated area. Short growing seasons, poor soil, and limited water make successful farming an impossibility. The income from fire work is a welcome addition to their economy. The 1951 season produced a revenue from fire work of over $100,000 for the three small tribes used most often. One group of three organized crews spent 16 days on suppression work in California and returned with checks which averaged $340 each.

Because of the many advantages in the service of these crews, the Forest Service is emphasizing their use in a trend away from pick-up labor. Ten top-flight crews are now available, and the region is currently negotiating with several other tribes and with the Indian Service in an effort to organize several more.

Indians are unconsciously safety minded. They watch each other, help each other, and warn each other of impending danger. Among the organized crews, we have yet to experience a lost-time accident though they have logged many thousands of hours of the most hazardous work—a truly outstanding record.

Through the many centuries that these people have lived in the Southwest, their everyday customs and essentials of life have found expression in colorful ceremonial dances. The fire dances, harvest dances, rain dances, and many others are as much a part of their lives as eating and sleeping. On one occasion a Hopi crew working on a particularly troublesome fire in southern California requested permission to put on a rain dance. Within 2 hours after their dance there was a veritable cloudburst. All that was left of the once troublesome fire was a mass of steaming mud. It would indeed have been difficult to convince any Indian in that group that the welcome rain was not a direct result of their ceremony. You can undoubtedly think of a number of organized fire crews that possess many of the qualities which make these Indian crews outstanding. Do you know of any that bring along their own rainstorms?

KEEP YOUR AX HANDLE TIGHT

HARVEY H. SMITH, *Wood Technologist,* and JOHN P. BURKE, *Forester*
California Forest and Range Experiment Station [1]

On a forest fire in Idaho two men were working together. As one man started to chop, his partner stepped back out of the way, but the ax, supposedly tight, slipped off the handle and struck him in the face. He spent many painful days in the hospital—and the accident could have been fatal. There is always the possibility that a loose ax head may fly off the handle as this one did, or it may slip, upset the chopper's balance or aim and cause the ax to glance.

The difficulty arises from the fact that we insert a shaft of wood, which can change in cross sectional area, into a steel eye which is virtually constant in cross section. Yet there is no better material for an ax handle than wood. It is light and strong, shock resistant, and flexible. Its low-heat conductivity makes it comfortable to hold in hot or cold weather. The solution then, is in keeping the handle tight.

Wood shrinks as it dries and swells when it becomes wet. Remember how doors sometimes stick on wet days and then swing freely again in dry weather? Ax handles swell and shrink with the same changes in the weather. Axes used for fire fighting are particularly troublesome. Many of them are necessarily kept in field cache boxes, which are usually tightly closed and placed in the sun where temperatures are extremely high and the air is dry. This shrinks the handles of axes and pulaski tools.

Scores of axes with factory-fitted handles have been inspected late in the fire season, after this drying effect had had a chance to work. Not a single ax that had been stored in cache boxes was found to be tight and safe. The axes stored in buildings, not being subjected to such high temperatures, were somewhat better. Even there, however, many handles had become loose and dangerous.

To make matters worse, many men hired for fire fighting are not skilled in the use of the ax. A highly skilled axeman senses any slight change in balance or impact which occurs when an ax handle is loose. The axeman is thus warned. The unskilled user chops on—without warning—until the accident occurs.

Several methods are used for tightening handles in axes which have been improperly hung or wedged, but most methods are at best no more than a temporary expedient. The handle can be soaked in water until it is tight, but when it dries out again it will be looser than before. Wetting causes the wood to swell, but the swelling is restrained by the eye of the ax. The forces that develop as the wood increases in moisture content will crush some of the wood fibers. These crushed fibers do not recover

[1] Maintained by the Forest Service, U.S. Department of Agriculture in cooperation with University of California, Berkeley.

when the wood dries, and the handle has actually shrunk to a size smaller than before. Repeated wetting and drying will cause further "compression set," and it will become increasingly difficult to keep the handle tight.

Adding a metal wedge to a loose fitting handle is little better than the water treatment because it also subjects the wood to stresses resulting in a compression set. A hardwood wedge does the same thing, and also acquires a compression set of its own. Neither the metal nor the hardwood has sufficient capacity to expand as the handle shrinks.

Loggers and logging companies have long been confronted with this problem, and many of them have found a satisfactory solution. For years large timber companies have bought axes and good handles separately. After the handles have been seasoned to a moisture content of 8 to 10 percent, competent men are put to work installing the handles, using a very dry softwood wedge, such as white pine. One company employing up to 2,400 woods workers follows this procedure, and old loggers have done so for years. Their ax handles stay tight.

Recently tests were run with factory-hung axes as a check, with axes fitted with softwood wedges, and with axes treated according to two other suggestions for keeping handles tight. One suggestion was to supplement the factory hardwood wedge with two flat-head No. 16 by 2-inch wood screws, firmly driven into holes properly drilled and countersunk. The other suggested method was to use an oil-base wood preservative, supposed to prevent shrinkage. After preparation, nine axes in each group were subjected to temperatures of 130° to 140° F. at low humidities, approximating field cache conditions, for 6 weeks. After this time each ax was driven securely into a log. The looseness of the handle in the eye was then determined by measuring the distance that the end of the handle had slipped. Results were:

Sample	*Number of axes*	*Number of tight axes, no slip*	*Range of slip (inches)*	*Average slip (inches)*
Factory check	9	0	0.06-0.69	0.30
Preservative oil	9	0	.16- .69	.44
Screw wedges	9	1	.00- .31	.18
Soft pine wedges	9	9	.00- .00	.00

Besides these 36 samples, 2 axes were refitted with soft pine wedges and the original factory handles, but it was necessary to cut nearly all the shoulder to get a good fit in the eye. These axes were included in the test to show the result of cutting away the shoulder. Neither remained tight, one slipping 0.03 inch, the other 0.16 inch. This limited sample indicates that a shoulder is necessary.

The superiority of softwood wedges is explained as follows: (1) Softwood exerts sufficient pressure to hold the well-fitted handle tight without crushing and damaging the hardwood fibers. (2) The softwood will adjust to shrinking and swelling of the hardwood throughout the range normally experienced under reasonable conditions of storage and use.

What is the practical meaning of this test? If you want a safe, serviceable ax, buy the head and handle separately, and hang the head yourself. Factory-fitted handles are not seasoned to "fire season dryness," and are wedged with a hardwood wedge, which is also somewhat moist. Metal wedges are often added, crushing the wood fibers. Here is how to guarantee a tight ax handle, usually for the life of the ax:

1. Get a straight, clear, well-seasoned hickory handle.
2. Inspect the eye of the ax for cracks. Remove bur edges at each end of the eye.
3. Fit the handle to the eye as closely as possible, clear through the eye, leaving ½-inch shoulder and a smooth wood surface in the eye. The shoulder should not bulge.
4. After the handle is fitted, remove it and saw a wedging slit down the center, parallel to the flat sides of the ax, to a depth that will be two-thirds the way through the eye when the handle is driven home.
5. Select a piece of sound, dry, straight-grained softwood, with annual rings parallel to the broad face of the wedge (flat-sawed lumber). It should be about ½-inch thick, as wide as the length of the eye, and not less than 6 inches long. Dress it down across the full width of the wedge so that it tapers gradually to a 1/16-inch-thick point which is then sharpened to a short, blunt edge. The wedge should have a rectangular cross section, except for slight rounding at the edges to fit the eye. It should be proportioned to exert pressure throughout its flat surfaces, the greatest pressure at the outer end of the eye.
6. Drive the handle firmly into position with 24-ounce hammer.
7. Drive the wedge into place as far as possible but avoid splitting it.
8. Saw off excess length, dress off with coarse file, and paint end.
9. Store axes in best cool, dry place available. Field caches should be ventilated and, if possible, placed in the shade. Though it is best to avoid wetting the ax handle, it will stay tight through considerable moisture change if properly fitted and wedged.

Is this procedure too much work? Ask the man who was struck by the flying ax.

New Device for Examining Lookout Coverage

The National Research Council and the Forestry Branch of the Federal Government are investigating jointly a new method for examining coverage from wooded hilltops in connection with lookout tower location. This involves the use of a collapsible 50-foot radio mast on top of which is mounted a camera using 35-millimetre film, operated and rotated from the ground by electrical control. The total weight of mast, camera, and all necessary tools and equipment is about 300 pounds. The maximum weight of any one piece is 15 pounds and the length of the longest mast section is 11 feet. About three hours is required from arrival at the site to departure, using a three-man crew.

The pictures, when enlarged nine diameters and mounted in panoramic form, show promise of considerable usefulness in determining lookout coverage. Some mechanical and optical improvements are now being made by the National Research Council. The possibility of reducing the weight and bulk of the equipment is also being studied.—From Forest Fire Protection Abstracts. Canada Dept. Resources and Devlmt. 2:5. 1951.

THE LAKE STATES BURNING INDEX METER

J. A. Mitchell
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The Lake States Burning Index Meter, issued first in 1936, is a device for rating the relative severity of burning conditions. It was developed for the use of forest officers and others responsible for forest fire control in the Lake States. As revised in 1949, it consists of a windowed envelope with a movable slide by which the factors considered can be integrated and their combined effect on the flammability of forest fuels rated (fig. 1).

The factors on which the meter is based are: (1) *the average moisture content of light fuels in the open*—determined from its correlation with condition of vegetation, precipitation, days since rain, and relative humidity, and (2) *current wind velocity*. To use the meter, the slide is first set so that the number of days without precipitation (since the last rain of half an inch or more) shows in the opening under "condition of vegetation." The "burning index" is then read from the table in the upper opening, under the current "relative humidity," and opposite the current "wind velocity." Each day thereafter on which no precipitation is recorded at 8 a. m. the slide is advanced one day. For days on which precipitation is recorded at 8 a. m., a pencil is inserted in the hole opposite the amount of rain observed and the slide retracted as far as it will go. Thus, *the period between rains*, as well as the amount of precipitation, is taken into consideration. For example: .23 inch of rain on the tenth "day since rain" (as shown on the meter) would set the meter back to the sixth day, while the same amount of precipitation on the sixth day would set it back to the second day. This is a unique feature of the Lake States meter.

The "burning index" indicates the relative severity of burning conditions *in percent of the worst probable*, 1 representing minimum severity, and 100 maximum. As pointed out, the scale is *relative*; that is to say, for any given level of "risk" (chance of fires being started) and "hazard" (determined by the character and amount of fuel present), the probability and severity of fires vary with the burning index.

Based on experience, the burning index ratings are divided into seven classes characterized in general as follows:

Safe (0-1).—Fires will not run beyond the heat of a campfire or burning brush pile.

Very low (2-3).—Fires will start from an open flame but spread slowly and tend to go out.

Low (4-6).—Fires will start from a lighted match and spread slowly (rapidly in dead grass) until extinguished.

Moderate (7-12).—Fires will start readily from a match, burn briskly, and tend to spread rapidly as they increase in size.

High (13-24).—Fires start readily from a match or glowing embers, spread rapidly, and tend to crown in young conifers.

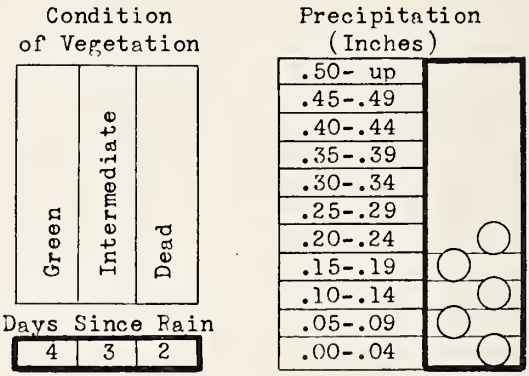
[1] Maintained by the U. S. Department of Agriculture, Forest Service, in cooperation with the University of Minnesota at University Farm, St. Paul 1, Minn.

LAKE STATES

BURNING INDEX METER

Relative Humidity - %								Wind Velocity m.p.h.
80 up	70 to 79	60 to 69	50 to 59	40 to 49	30 to 39	20 to 29	10 to 19	
0	1	1	2	3	5	7	10	0 - 3
1	1	2	3	4	6	9	13	4 - 6
1	1	2	4	5	8	11	17	7 - 12
1	2	3	5	7	10	14	21	13 - 18
1	3	4	6	9	13	18	26	19 - 24
2	4	6	8	11	16	23	32	25 - up

Burning Index



Directions

Set slide to show (under "Condition of Vegetation" prevailing) the number of days without rain, since the last rain of .50" or more.

Advance slide one day for each day without rain thereafter.

For subsequent rains, insert a pencil in the hole opposite the amount of precipitation and retract slide as far as it will go.

"Burning Index" indicated opposite current "Wind Velocity" under current "Relative Humidity."

1949

FIGURE 1.—Lake States burning index meter.

Very high (25-49).—Fires will start from burning tobacco or sparks, spread rapidly, and tend to crown generally. Spot fires common.

Extreme (50-100).—Explosive conditions. Fires start readily from sparks, burn fiercely, and tend to crown and spot generally.

Standard practice calls for daily observations at 8 a. m., noon, and 5 p. m. from April 1 to October 31. In years when the fire season opens earlier or closes later the period of observation is extended accordingly. The minimum equipment required consists of a rain gauge, a sling psychrometer, relative humidity tables, an anemometer indicating wind velocity in miles per hour, a Lake States Burning Index Meter, and forms for recording observations. The observations called for are: condition of vegetation, precipitation, relative humidity, and wind velocity.

The theory on which the Lake States and most other burning index meters are based is that fuel moisture content and wind velocity are primarily responsible for the degree of flammability or severity of burning conditions prevailing. Because we are dealing with a complex aggregation of fuels which vary widely in amount, density, and exposure, the *average* moisture content of the primary fuels (together with wind velocity) is the best measure we have of the prevailing level of flammability. In the Lake States, heavy fuels are not, as a rule, an important consideration. The condition of light fuels in the open is, therefore, used as the criterion of burning conditions because this largely determines fire occurrence and behavior.

Because it is impractical to determine the *average* fuel moisture currently by direct measurement, it is arrived at indirectly from its correlation with the principal factors which determine it (i.e., condition of vegetation, precipitation, days since rain, and relative humidity).

"Condition of vegetation" is rated by the observer or district fire control officer as "dead," "green," or "intermediate" on the basis of prevailing conditions. "Green" is used when the grass and herbaceous vegetation is green and the broadleaf trees and shrubs are in full leaf. In the Lake States, this roughly coincides with summer and usually prevails from early June until mid-September. It varies, however, from year to year and from place to place; hence, is not tied to specific dates. "Dead" is used when the grass and herbaceous vegetation are dead or cured and the hardwood leaves (with minor exceptions) have fallen. This condition is typical of the spring and fall fire seasons. "Intermediate," formerly called "curing," applies to the transition period between green and dead and dead and green. This condition is usually of short duration (10-20 days) and confined to late spring when the grass is well started but the hardwood leaves are not yet fully developed and to early fall when the annual vegetation is cured or dead but the hardwood leaves have not yet fallen. It can also prevail in summer as the result of a prolonged drought and the consequent drying up of grass and herbaceous vegetation.

"Precipitation" is measured each morning at 8 a. m. Less than .005 of an inch is recorded as a trace but ignored in setting the meter. For the first setting of the meter, the amount of the "last rain" is taken as the total precipitation occurring on consecutive days and must amount to half an inch or more. Subsequent rains are considered day by day, the meter being set back according to the amount of precipitation occurring. If rain occurs between 8 a.m. and noon or between noon and 5 p.m., it should be measured and the meter set back accordingly at the time of

the noon or 5 p.m. observation, in which case amount measured is deducted from the total for the 24-hour period in setting the meter the following morning.

"Days since rain" is counted from the day on which precipitation is last recorded at 8 a.m. Following rains of half an inch or more it will always show as one day. When the meter is set back for less than half an inch of rain, the number of days showing on the meter or "meter days" depends on both the amount of precipitation and the number of days the meter has been advanced. In no case, however, is the meter set back beyond the first day for the condition of vegetation prevailing. In case of snow, "days since" is counted from the first day that enough fuel is exposed for fires to run.

The prevailing "relative humidity" and "wind velocity" are used in determining the current "burning index." Normally, the "burning index" is determined daily at 8 a.m., noon, and 5 p.m. It can, however, be determined at other times if desired, for example, when conditions are acute or there is a fire burning.

The number and location of fire-weather stations are determined by the homogeneity of conditions, the availability of a suitable exposure for the rain gauge and anemometer, the availability of an observer, and by administrative considerations. As a rule, one fire-weather station in each protection district is ample. For administrative reasons, it is desirable to make the observations at the dispatching center or protection headquarters. Where conditions at headquarters are not representative or where a suitable site for the instruments is not locally available, the fire-weather station is located at the nearest point where conditions are suitable and an observer is available.

The burning index ratings serve two major purposes. First, they indicate the severity of burning conditions prevailing currently, as a guide for administrative action—manning of lookouts, need for stand-by crews, strength and speed of attack called for, etc. Second, and equally important, they make possible a comparison of conditions prevailing from place to place and from time to time. They serve also to call attention to the build-up of acute conditions and provide a basis for determining the normal severity of conditions and for judging the progress and efficiency of fire control effort.

Prevailing burning conditions are best shown by a chart on which the maximum burning index recorded each day is indicated graphically. Such a chart shows at a glance conditions from day to day throughout the fire season; the date, duration, and severity of acute periods; and currently the build-up of acute conditions. Years, seasons, and protection units can be rated for comparison by averaging the burning index ratings for the periods or units in question. For this purpose, days are rated on the basis of their maximum burning index. This is of value in over-all protection planning, in the allotment of protection funds, and in the assignment of personnel and equipment. The number of days in each burning index class is also useful in determining the normal fire load, its seasonal distribution, and the probable cost of effective protection. Last but not least, burning index ratings make it possible to properly rate accomplishment and the efficiency of fire control effort by providing a measure of the severity of conditions prevailing.

While the Lake States Burning Index Meter rates current conditions, it is useful, in connection with weather forecasts, in determining the severity of conditions likely to prevail. For example, if the weather forecast gives the relative humidity and wind velocity expected the following day, the probable burning index can be determined by advancing the slide one day and using the predicted humidity and wind velocity. Lacking a forecast, it is common practice to assume that the humidity will be at least as low as for the current day and to advance the slide one day to get a rough idea of what to expect. In settled weather also, afternoon conditions can be approximated from the 8 a.m. observations by using half of the 8 a.m. relative humidity to determine the probable afternoon burning index.

Because the Lake States meter is based on empirical data, it is not recommended for use where conditions are materially different from those prevailing in the Lake States, for example, where heavy fuels or elevation and aspect are important considerations, or where the fire season is continuous and of long duration. In the Lake States, heavy fuels are the exception rather than the rule; elevation is not a factor, and aspect is only locally important. Normally, also, "lows" occur at frequent intervals and more than two weeks without rain is unusual. On the other hand, the fire season is intermittent and erratic, and acute conditions can occur, after a few days of drying weather, any time the ground is not snow covered. Fire periods, however, are seldom of long duration. Most fires also start and burn in the open. Only under extreme conditions will fires run in mature timber. Acute burning conditions are indicated long before this condition is reached, however.

Local rains are the chief cause of unsatisfactory meter ratings because they can result in a wide variation of conditions in a relatively small area. This, however, is no fault of the meter because meter ratings are necessarily based on conditions prevailing at the point of observation. To meet this difficulty, supplemental observations of precipitation at outlying points are advisable to avoid being misled by local conditions, particularly in summer when local rains are frequent.

The Lake States Burning Index Meter has been revised several times and doubtless will be improved in the future as knowledge and understanding of fire and weather relationships increase. Experience has demonstrated that the basis of the present meter is sound and that, when properly used, it can be depended on to indicate the relative severity of burning conditions prevailing. No meter, however, can account for all of the factors and contingencies that affect fire occurrence and behavior, or eliminate the need for experience and judgment in determining the action called for in specific cases. The best that it can do is to indicate average conditions resulting from given combinations of the factors considered.

MOUNTING THE NEW MOBILE RADIOS WITH WEATHERPROOF CASE

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A number of satisfactory methods have been developed for mounting the various makes of mobile radios externally on pickups and trucks. In publishing this one we do not intend to infer that it is superior to all others we have seen. Rather we wish to make available to those who are still seeking a solution to the mounting problem for this particular unit an answer that appears quite simple and satisfactory.

This model 1147-5-1 mobile radio was specially developed by the manufacturer in cooperation with Northwest loggers who wanted a unit that could be mounted directly on the side of a pickup in the space just ahead of the rear fender. In connection with developing other mounting arrangements the company's manual cautions that (a) the 12-inch width dimension must always be kept in a horizontal plane and (b) vertical mountings on the ends of long vertical brackets should be avoided where excessive vibration might result. The diagonal brace included by Mr. Gardner to stiffen his mounting should eliminate harmful vibration.—*Ed.*

A mounting arrangement for the new mobile radios (Model #1147-5-1) which offers many advantages has been devised and is being used in Region 3. The mount is based upon use of the weatherproof case which can be obtained for these units.

The basic mount consists of three ¼- by 2- by 42-inch pieces of mild steel drilled to bolt to the case and into a corner of a pickup or truck bed. The pieces of steel are first bolted to the case with 5/16- by 1-inch carriage bolts (fig. 1). By drilling the holes ⅜ inch the bolts will force fit most effectively. Punched gasket material is placed under the heads of the bolts on the inside of the case to insure a weathertight fit. The bolts will

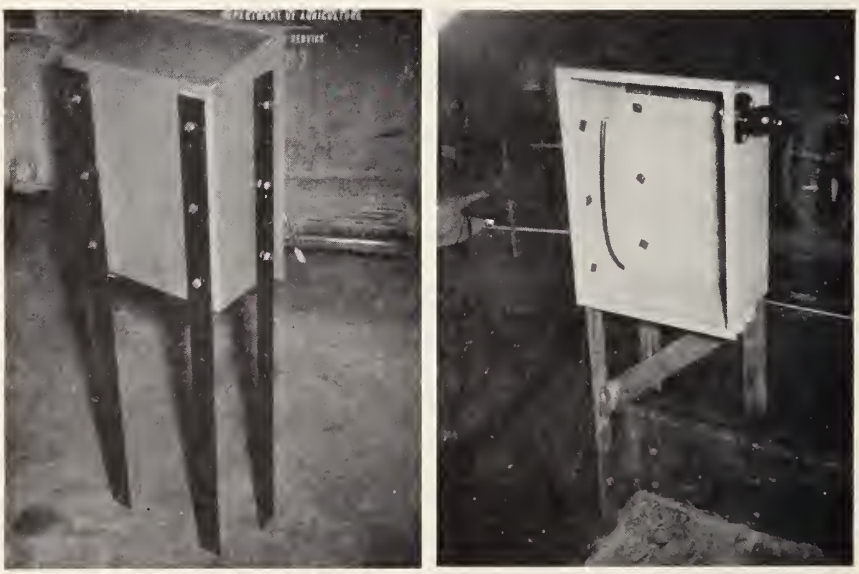

Figure 1.—*Left,* Steel supports are bolted to case. *Right,* Bracing insures rigidity.

pull up and the heads will not interfere with the fitting of the chassis into the case.

A diagonal brace of the same steel as the legs is welded between the front leg and the one diagonally across the case to the back. Bracing this back leg as near the bottom of the case as possible is essential to rigidity of the mount (fig. 1).

This mount may be bolted into the left front corner of pickup or truck bed with two of the legs on the outside, where the headboard curls in (see fig. 2), or with all legs on the inside where the headboard curls outward as in the power wagon.

FIGURE 2.—Case mounted on pickup.

The antenna is mounted directly on the case, which comes with the necessary holes already punched.

Some of the advantages realized are:

1. Mount is adaptable to various makes and sizes of trucks.
2. Mutilation of cabs of trucks is avoided. (Some cabs do not have enough room between top and liner to accommodate roof-top antenna mounting.)
3. Radio is very accessible to technician for maintenance and repair.
4. No space is taken from the pickup or truck bed.
5. Antenna is mounted high enough and sufficiently in the clear to permit nearly optimum results in all directions.
6. Radios can be installed with ease and speed.
7. Radio is mounted approximately midway between front and back wheels for best riding conditions.
8. Short antenna cable reduces transmission losses to minimum.

Tests made with these mobile radios using this mount showed better than expected results. At extreme marginal conditions, some directivity was observed slightly to the right of front of vehicle. This could be expected from the ground-plane effect of the cab roof-hood combination lowering the angle of maximum transmission radiation in that direction.

RADIO MOUNT IN ¼-TON JEEP

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Chief of Fire Control, Missouri Conservation Commission

The 4-wheel drive jeep has proved extremely valuable in many States as a fire fighting vehicle. During the past 6 years about 60 ¼-ton civilian jeeps and 20 1-ton jeep 4 x 4 trucks have replaced pickups and conventional trucks as fire fighting units in Missouri. One disadvantage of the small ¼-ton jeep has always been limitation of space. Until recently all jeep radio installations were made in a waterproof box carried in a 3-foot bed extension at the rear of the jeep.

A new-type FM radio unit, Model FMT-R-41 V, (DF) 1 C (Front Mount) is almost tailor-made for the small jeep. The radio itself is a 12-watt set with the control panel and speaker mounted in the front of the single cabinet. It is a self-contained unit requiring only antenna and battery connections to place it in operation. This radio is available either for the 30-40 mc. band or the 152 mc. band and can be obtained for operation on one or two frequencies.

In the ¼-ton jeep this radio is mounted between the two front seats with the control panel forward (fig. 1). The extra passenger or right-hand

Figure 1.—FM radio mounted between front seats of a ¼-ton jeep.

seat is moved to the right about 2 inches to make room for the radio. This is a simple operation for anyone with a portable electric drill. The radio is mounted on three small rubber shock mounts of the type normally used for refrigerator units. Controls and microphone are easily accessible to the driver or passengers in either the front or rear seats.

In transporting fire crews it is often necessary to carry three passengers in the front seats. To prevent damage to the radio and still be able to carry the extra passenger, a steel plate or guard has been mounted over the radio. The original pattern was designed and built by Merald W. Johns on the Lake Ozarks District. The supports are secured to the floor with bolts and wing nuts so that the plate is easily removed to provide access to the radio. Holes are cut in the plate for the control knobs and speaker. The entire installation requires only about 3 hours, and the protective plate can be made in any machine shop for about $5.

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Forest Fire Damage Appraisal Procedures and Tables for the Northeast, by A. W. Lindenmuth, J. J. Keetch, R. M. Nelson. U. S. Forest Serv. Southeast. Forest Expt. Sta. Paper 11. 28 pp. Sept. 1951.

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Holy Old Mackinaw in the Smoke, by H. V. Simpson. Amer. Forests. Nov. 1951.

LONG-ROPE PARACHUTE

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The long-rope parachute, nicknamed "long-tailed chute," has been successfully used for dropping light loads in timbered country for two seasons. Although the action of the long rope, in letting loads down through thick timber, is desirable for dropping heavy loads up to 150 pounds, we have previously confined the use of this development to light loads of 50 or 60 pounds.

The long-rope parachute consists of a standard canopy with regular load lines, but it is packed in a manner which allows the load to hang on the bottom of a long rope during descent. Its principal use is in tall timber where the regular parachutes, with the load attached in the normal manner, often hang up in the tree tops. This necessitates considerable delay in retrieving both the parachute and the load, and often results in damage if the tree is felled.

The load, upon entering the tall timber, is stopped from any forward motion, and the parachute drifts on. As the package descends to the ground the long rope will be caught by limbs which cause the parachute to act as a drag or brake in letting the load down to the ground. There is very little landing shock because of friction of the rope over branches, and the braking action of the parachute as it is pulled back to the tree by the descending load. The long rope, from the parachute to the ground, greatly facilitates the removal of the parachute from the trees, and usually eliminates climbing or felling to retrieve the canopy.

When we attempted to drop heavier loads of 150 to 170 pounds, the number of "break-aways" presented a serious problem. Observation and pictures pointed to the trouble: the parachute became inflated before the load reached the end of the long rope. There was no deceleration of the package as the parachute inflated, and a terrific shock resulted when the load reached the end of the line.

We tried ⅜- and ½-inch nylon rope. They held for one or two drops, but could not be depended upon after that. Apparently the shock came too quickly to allow the natural stretch of the rope to take place. This was indicated by breakage which always occurred within 1 or 2 feet of attachment, either at the parachute or at the load. Other things, such as several sizes of rings on the load lines to slow down the opening of the parachute, various packing methods, and rubber shock absorbers made of heavy bungee cord, were tried with more or less success. Twisting the suspension lines provided an effective method of slowing down the opening, and it was very easy to do; but 20 test drops failed to show a consistent opening speed, which is necessary for accurate spotting of loads. One method, consisting of four rings used to divide the load lines and placed near the perimeter of the chute in a manner which retarded the

opening until the rings could slide down the lines, was unsuccessful for the purpose intended, but it did reduce oscillation considerably. This may be worth further experimentation, since oscillation is one of the major contributors to landing damage.

Later experiments used a simple extraction chute, which was opened by the static line in the ship, and which in turn opened the large freight chute after the load had reached the bottom of the long line (figs. 1 and 2). This method has been definitely established as the most positive arrangement for deployment of the long rope. Final tests were completed on May 14, 1951, and the job breakdown and instructions posted for use by riggers.

For those familiar with packing procedures, the following brief description will be of interest:

An 8-foot bomb parachute (or a similar chute used for extraction) in a muslin sack is tied securely into the apex lines of the standard freight chute. From all appearances this resembles a pilot chute. The standard freight parachute is packed with normal procedure, except that the one strand of 8-cord, which laces the container, is run through the attaching loop of the bomb or pilot chute. In other words, instead of passing the lacing cord through a break ring, it is passed through the loop formed by the bomb chute lines.

The bomb or pilot chute is stowed, lines first, in the muslin sack and a 1-inch cargo break ring tied into the apex with a single strand of 5-cord. This single strand should be about 4 inches long. The bomb or pilot chute is pushed into the sack far enough to allow gathering the open end (with the ring hanging out), doubling it, and looping a doubled No. 32 rubber

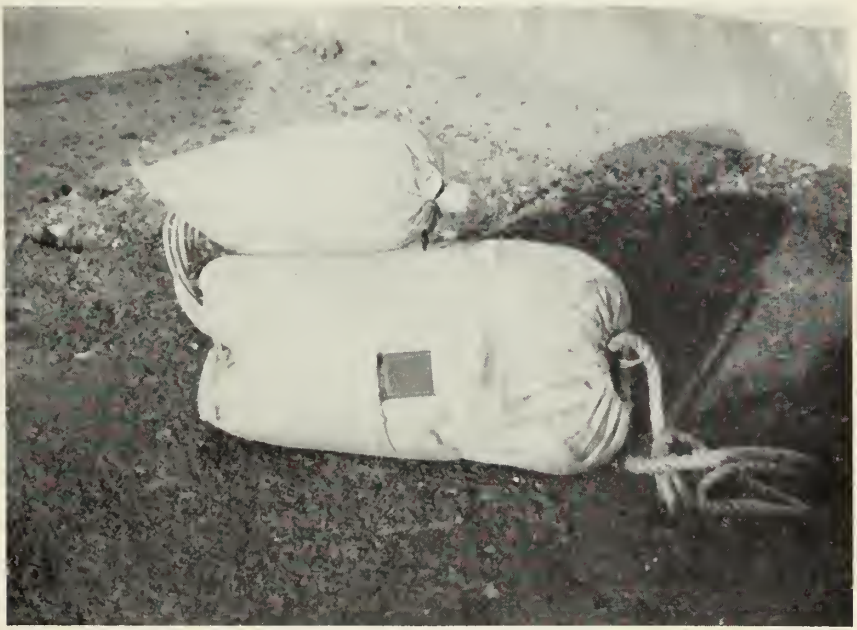

FIGURE 1.—Long-rope parachute with pilot chute.

FIGURE 2.—Long-rope parachute partially deployed. Pilot chute is pulled out by static line. Main cargo chute does not open until load has reached the end of the 75-foot rope extension.

band over the folded end of the sack. The extraction and freight chutes are now packed.

Next, the 75-foot, ½-inch hemp rope is stowed in the same manner as the freight chute suspension lines. These stows should be held with heavy No. 50 rubber bands. Place the rope stows inside the bungee container, leaving about 3 feet of rope hanging out. Next, tie a single strand of 8-cord to the "V" ring of the freight chute riser with a bowline knot, and then tie the other end to the free end of the rope at the point where it emerges from the bungee container. Use a clove hitch to tie the 8-cord to the rope.

The hemp rope should be attached to the webbing of the cargo chute riser loop with a clove hitch followed by two half hitches.

When the rope is attached to the cargo bundle, care should be taken to pad or otherwise reinforce the point of attachment so the rope cannot shear itself with its own knot. If a heavy webbing loop is provided, the attaching knot should be a jam hitch with the running end wrapped twice around the base of the loop before it is extended back through the loop.

Drawings and complete instructions are available upon request.

MICHIGAN HYDRAULIC SULKY PLOW

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Currently being tried in Michigan is a recent development in sulky plows using hydraulic controls. This new edition, the pilot model of this design, has undergone two seasons of field testing with good success. Performance data is still being gathered and studied. No attempt has been made to standardize on this unit as a general fire tool in the State. Past history of the plow, however, gives it better than an average chance of acceptance for forest fire control.

Being classed in the light-heavy or semi-heavy group, this unit weighs 1,400 pounds, almost all of which is acting on the plow when it is in operation. The basic design is similar to the standard heavier sulky plows in Michigan, the main differences being in the control mechanism and the size. The heavier and larger Michigan sulkies are winch-controlled and fall in the 2,000-pound class, and their bottoms have a wider spread.

Best application of the new hydraulic plow is yet to be determined, but it appears that it will find its place behind a crawler tractor of 20 or 30 horsepower, depending somewhat on assignment (fig. 1). In actual tests a four-wheel-drive power wagon handled the plow with good results. At the time of these tests the possibility of using this plow regularly with the power wagon was seriously considered. One drawback to this practice, however, was the difficulty encountered in trying to back up while in the woods. Operator experience and slight mechanical improvements have remedied this situation somewhat.

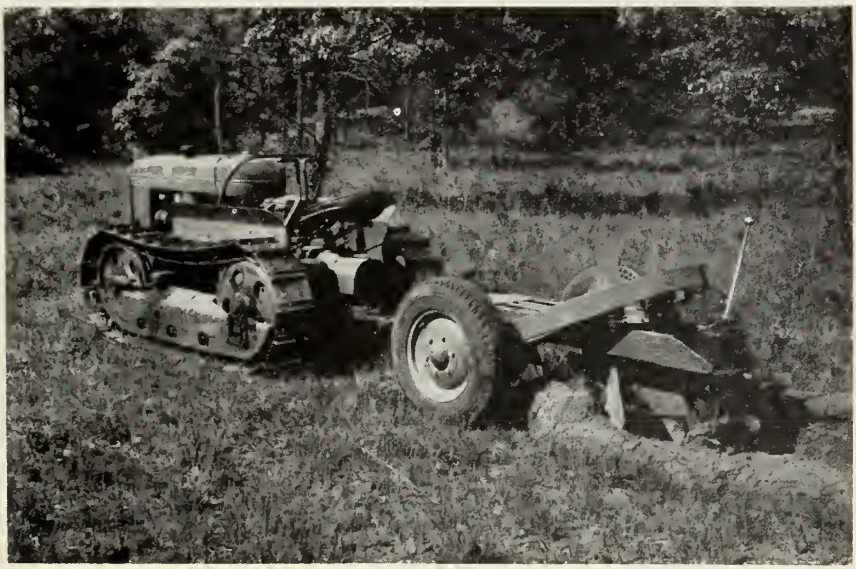

FIGURE 1.—Michigan hydraulic sulky plow in working position.

The hydraulic sulky is rugged in construction and presents a low silhouette. It is mounted on heavy-duty rubber tires and may be towed at any safe vehicle speed on the highway. The balance points are so placed as to permit one man to handle the entire plow just as easily as he would a light trailer. The reenforced U-shaped carriage insures adequate strength even for the most severe fire conditions. The beam is of 5-inch, 9-pound-section, channel iron. A 24-inch rolling coulter and 2 cut-down, 18-inch, plow bottoms make up the principal components of this machine. The bottoms are cut down to reduce the drawbar power requirements. The head casting provides for adaptors for quick attachment to either tractors or trucks. Experiments with satisfying results have been run on the use of the trailer type ball hitch for plowing. There seems to be no objection to this practice if the maximum capacity of the hitch is not exceeded, and if caution is taken to strengthen the ball assembly.

Though hand operated, the hydraulic section of this plow provides an easy and efficient control device for raising and lowering the carriage. It is in this action that the plow is unique since many factors are centered around the proper functioning of the carriage. It must be remembered that the transportation of the unit, the stability and correct action while plowing, the most advantageous distribution of weight, and the safe and efficient operation of the plow are all affected by the carriage design. With the single-acting hydraulic cylinder used in this design, the carriage is allowed to float when plowing. Normally this means that almost the entire weight of the carriage is then resting on the plow thus giving a desirable added weight for penetration on most tough plowing chances. The floating action is particularly helpful in rough and irregular ground.

FIGURE 2.—Michigan hydraulic sulky plow in raised position.

When through plowing, or for any other reasons that may arise, the operator can raise the carriage by use of the hand pump on the rear of the plow (fig. 2). A pin is used for positive locking for highway travel to relieve the load on the hydraulic system and to insure safe travel. The hydraulic cylinder is actuated in one direction by gravity, as in plowing, and it is moved in the opposite direction, as in lifting the plow, by the hand pump.

Briefly, specifications on this unit are as follows:

Type: Double-bottom sulky on rubber tires
Weight: 1,400 pounds
Length: 80 inches
Height: 53 inches
Bottoms: 11-inch right and left steel bottoms, cut down from 18 inches
Rolling coulter: 24 inches diameter
Control: Hydraulic
Total width of line: 66 inches

Prints, specifications, and other information about this plow and other Michigan equipment may be obtained from the Department of Conservation, Lansing, Mich.; or from the Michigan Forest Fire Experiment Station, Roscommon, Mich.

New Fire Line Tool

In Ontario a hoe type of tool with a shovel steel blade of 6 inch by 6 inch dimension and having a small, light axe head forged or welded to the top of the handle socket is being tried out, and is receiving favourable comment from fire fighters as an excellent trenching tool. The small axe head, about 3 inches long with a 3-inch face, is handy for cutting roots in the trench and the hoe blade is found to be more efficient than a shovel in scraping off leaf and moss litter. The tool is intended to complement the shovels and axes now used on the fire line.—(Report on Forest Fire Research in Canada, January 1948 to July 1949, Canadian Society of Forest Engineers) From Forest Fire Protection Abstracts. Canada Dept. Resources and Devlmt. 1:19. 1950.

A NEW TYPE OF COMPASS FOR SMOKECHASERS

GAIL C. BAKER
Staff Assistant, Deschutes National Forest

The Deschutes National Forest was given the assignment of trying out a new compass during the 1951 fire season. A supply of these compasses sufficient to equip all the firemen on one ranger district was received on the forest in June shortly before the guard training camp. We included instruction for their use in the smokechasing course and discovered that the instruction job, which consisted basically of proper holding, boxing the needle, and sighting, was greatly simplified (fig. 1). The problems of getting the needle to settle quickly, being careful that it was swinging free, and the troublesome reversal of east and west, which characterize the standard box, were eliminated.

As part of our guard camp program each year we have a compass contest. A 10-sided, closed traverse is staked on the ground and the angles measured carefully with a staff compass. All trainees at the camp are required to run out this course in their spare time using their pocket compasses. The winner and the runner-up in this year's contest were both using the new compass, and their cumulative error was less than 2 degrees. This compares with a low error of approximately 5 degrees for the standard box compass.

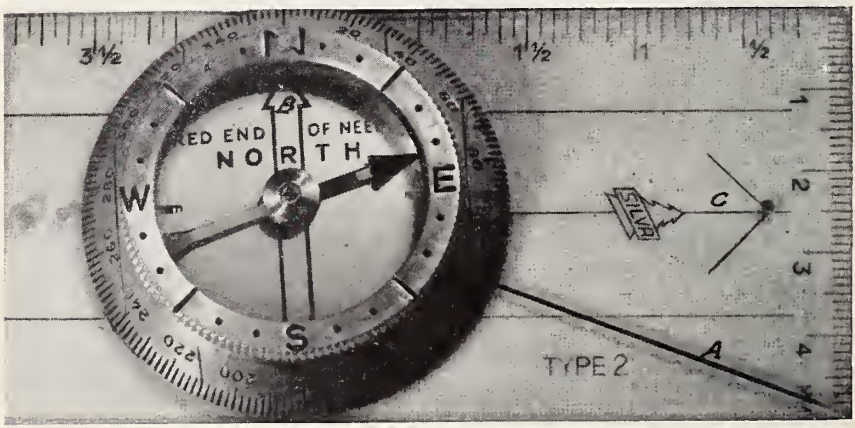

FIGURE 1.—Operation of the compass is simplified if the graduations on the back are disregarded. Set off the magnetic declination by scratching and then inking in line *A* (called target line). Declination in photo is set off for 20° (each mark on the compass housing is 2°). To run a compass course: (1) Set desired azimuth on target line *A*; (2) hold the compass in the usual manner with the "line of sight" arrow *C* in front of the body; (3) turn the body (and compass) until the magnetic needle is in the etched needle box *B* inside the compass housing. Your course is then line of sight *C*.

The District Ranger, his assistant, the fire control officer on the forest, and 10 firemen had the opportunity of trying out this type of compass during the past season, and they consider it far superior to the standard box type compass. It appears to have the following advantages:

1. The needle is quick-settling, thus saving considerable time in taking a reading.
2. It has no lid to spring open accidentally and allow the needle to fall off the pivot or become demagnetized. The needle is in liquid, and it swings freely in any position.
3. The cover is shatterproof.
4. It is very light in weight and can be carried in the shirt pocket without notice.
5. There is an inch scale on the plastic base which can also be used as a straight edge.
6. It can be set on any azimuth reading and will remain there until a new reading is desired.
7. The east and west is not reversed. Thus a source of confusion is eliminated for trainees.
8. The azimuth circle is numbered clockwise, the same as the trainee's protractor (not counter-clockwise as on the box type compass), thus aiding the trainee in his sense of direction rather than confusing him.
9. It is simple to understand and operate, thus saving considerable time in training.
10. It costs much less. The present price is $4, compared with about $10 for the box type.
11. It should require very little maintenance; the box compass requires frequent and expensive maintenance work.

The Procedure and Cost of Conducting Forest Protection Analysis

The Western Forestry and Conservation Association has issued a series of reports on "Various Recommended Forest Practices and Techniques." One of the reports deals with "The Procedure and Cost of Conducting Forest Protection Analysis."

This protection report covers the following points:—

(1) The determination of present standards.

(2) The determination of improvements necessary for raising standards or for maintaining existing standards at lower cost.

(3) The justification of recommendations for improvements.

It also gives an outline of the costs involved in making protection analyses.—From Forest Fire Protection Abstracts. Canada Dept. Resources and Devlmt. 2:23. 1951.

IMPROVED SMOKE CANDLE

A. B. Everts
Equipment Engineer, Division of Fire Control, Region 6,
U. S. Forest Service

Samples of an improved smoke candle were furnished by the Washington Office to Herbert K. Harris, Region 1, and Jack S. Barrows, Northern Rocky Mountain Forest and Range Experiment Station, for testing in connection with an intensive visibility and detection study. Others were supplied the author and William G. Morris, Pacific Northwest Forest and Range Experiment Station, for testing in an attempt to develop a device capable of generating sufficient smoke to clear 150-foot trees without dispersal. The findings of the investigators are combined in this report.

According to Harris, burning time of 91 candles varied from 8 to 19 minutes, depending to some extent on the relative humidity. The average was 12.6 minutes.

Figure 1.—Smoke produced by a candle. There was no noticeable wind in the deep timber, but natural draft along the roadside was sufficient to "pull" the smoke horizontally. In this case the smoke did not rise above the trees.

Out of some 130 candles used in tests the investigators reported 14 fuse failures. If a fuse burned out, considerable heat was required to ignite the chemical. Fuses were used for this purpose. When a candle is first ignited, a "plug" of hot, glowing chemical breaks loose from the end. This plug could set a fire.

Smoke color was adjudged very good by all observers.

Smoke rise was not good (fig. 1). This is probably due to lack of sufficient volume and heat. Application of additional heat resulted in little if any increase in the smoke rise because of a reduction in the volume. Best results were obtained by concentrating the smoke behind a flat rock or board with approximately 1 square foot area. This caused puffs of smoke which took longer to dissipate and consequently attained a greater elevation at times.

Volume was sufficient for most use on still days. Wind velocities of 3 or 4 miles per hour reduced the visibility distance considerably by causing the smoke to drift close to the ground until too thin for detection at maximum distances.

Visibility of the smoke was very good when it was rising and spreading normally and without wind gusts. Smoke was seen very clearly at a distance of 14 miles by Region 1 observers looking toward the sun in preliminary tests. For maximum distance the smoke must be established in open areas because of its small volume. No visibility tests were made in Region 6; smoke would not rise in timber under any conditions without too much dispersal. It was agreed that for open areas, brush fields, and young reproduction the candle is superior to any tried out before.

Two types of balloons to lift the candle above the tree tops were tried in Region 6, but the weather balloons were the only successful ones. These

FIGURE 2.—A weather balloon filled with cylinder hydrogen lifted the 1-pound candle 175 feet into the air.

can be inflated to a diameter of 5 feet or more with cylinder hydrogen in a minute's time. Hydrogen costs $2.16 per 100 cubic feet; the smallest container is the 191-cubic-foot size, weighing 135 pounds. Hydrogen is explosive, and it is believed it should not be used generally. Helium is safe, but the cost is high, $13 per 100 cubic feet.

A 1-pound smoke candle was attached to a balloon with a copper wire. Then a 175-foot length of stout cord was tied to the candle. The balloon had sufficient lift to take the candle straight up (fig. 2). No difficulty was experienced in "steering" the balloon through the trees. This method will get the smoke up where it should be visible for considerable distance.

Combination Pressure Relief and Check Valve

We have found that placing a separate pressure relief valve somewhere in a hose line is a great inconvenience. Consequently, we have taken a combination check and bleeder valve and brazed an adjustable, automatic pressure relief valve to the check valve cover plate. This gives the pump operator full control over the pressure relief valve setting and eliminates a second piece of equipment. Also, by having the relief valve in this spot, if a pressure that is higher than the relief valve setting is needed, it is instantly obtainable by the pumper operator; and he may accurately control this setting because he has the pump gauge to work by.

The automatic relief valve which is used should be one of ¾-inch capacity, adjustable between 160 and 225 pounds with a hand wheel and lock nut on the valve stem. However, any good adjustable relief valve will do the job. The pressure relief valve should be disassembled and the check valve cover plate removed during the brazing. Care should be taken to prevent excess heat from distorting the seat of the check valve or the pressure relief valve.—Alwin E. Hodson, Jr., *Chief Fire Warden, Nobscot Reservation, Framingham and Sudbury, Mass.*

FIGURE 1.—Complete pressure relief assembly: 1, Check and bleeder valve; 2, automatic pressure relief valve; 3, relief valve lock nut with finger wings; 4, point at which automatic relief valve is brazed to the check valve cover.

THE TREE PUSHER

C. E. Hein
General Foreman, Deschutes National Forest

The Bureau of Reclamation engineers designed a Tree Pusher mounted on a land-clearing blade to clear lodgepole pine from the Wickiup Reservoir site. At the completion of the clearing project, the Deschutes National Forest purchased a surplus Tree Pusher from the Bureau and fitted the attachment to an Isaacson land-clearing blade mounted on a D-7 tractor. A major improvement was made in the Bureau's design by welding short heavy teeth to the pusher bar; this makes possible a better grip on the trees and enables the tractor operator to better control the direction of fall (fig. 1).

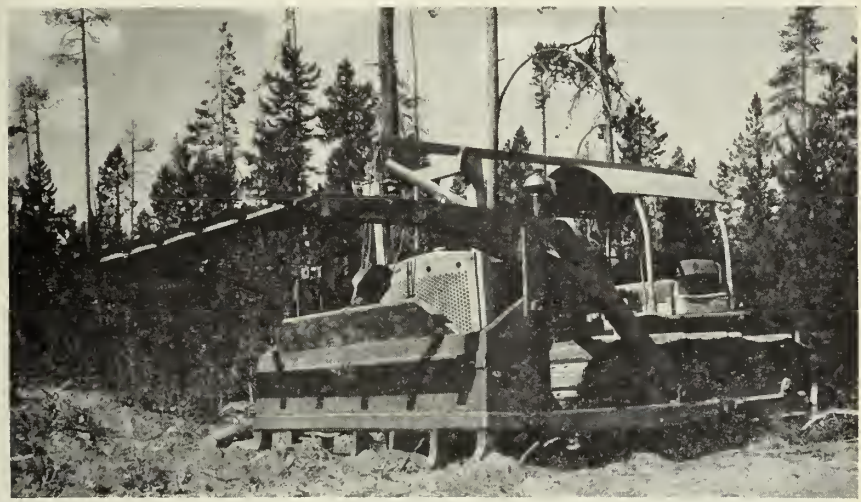

Figure 1.

The improved Tree Pusher has been used on road right-of-way clearing through lodgepole areas where a few trees of ponderosa pine and white fir have been in the cleared strip. Trees up to 24 inches in diameter are easily pushed and trees as large as 40 inches have been pushed in favorable locations. The added weight of the Tree Pusher is a slight handicap governing the maneuverability of the tractor. Pushing activities should be confined to relatively level ground.

In road right-of-way clearing, an average of three tractor-hours per acre was expended on clearing work. Using this accomplishment as a measuring stick, it is safe to assume that in clearing a 10-foot fire line (width of dozer blade), about one-fourth mile per hour could be cleared.

The operator is protected by a steel canopy and is instructed to push only those trees that will come with a continuous forward motion of the tractor. "Rocking trees" is prohibited as a safety measure.

A TRACTOR-DRAWN FIRE RAKE

William E. Towell
Assistant State Forester, Missouri Conservation Commission

An entirely new principle in fire line construction has shown exceptional promise in initial tests in Missouri. This new fire rake is a special adaptation of the Ferguson side-delivery hay rake. Those who have seen the fire rake in operation are confident that the principle is a long-sought answer to mechanical fire line construction in the central hardwood region.

The possibilities for use of a fire rake as a fire fighting tool were first realized by District Forester Lee C. Fine, of Sullivan, Mo., and his assistant, Harold J. Reutz, of Steelville, Mo. Fine and Reutz watched a Ferguson side-delivery hay rake in a field and arranged to try one in the woods. In spite of excessive width of the hay rake and the resultant poor maneuverability in the woods, it raked a good fire line. Observation of this trial enabled the manufacturer to obtain several ideas for modification of the tool for fire fighting purposes.

The fire model is a miniature of the commercial hay rake. It is sturdier in construction and was designed so that the width would not exceed the outside wheel width of the farm tractor (fig. 1). It is connected to the tractor by the standard three-point hydraulic lift connections and is powered by a drive shaft fastened to the rear power take-off of the tractor. The speed of the rake is governed by the speed of the tractor engine. The entire rake is raised or lowered by the hydraulic lift, and an alert operator can raise it over large obstructions.

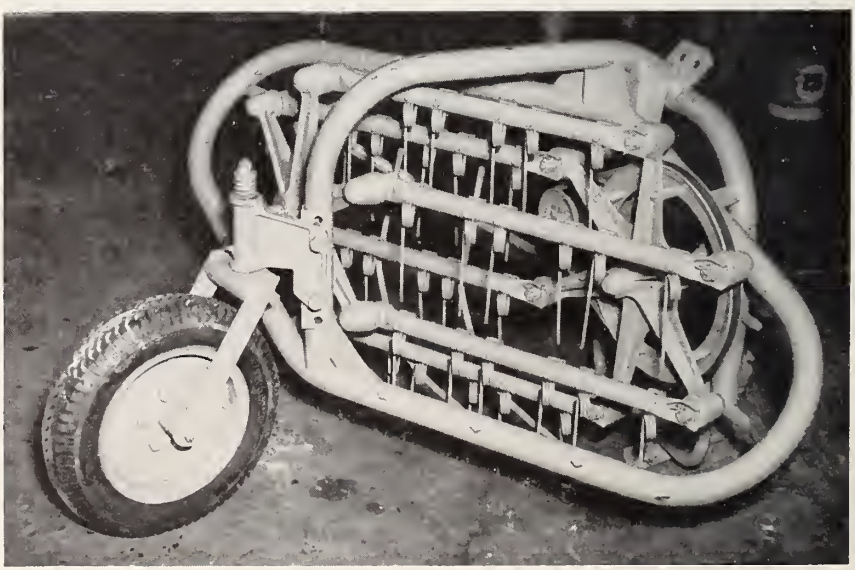

Figure 1.—The tractor-drawn fire rake. (Photo courtesy Mo. Conserv. Commission.)

The spring steel teeth move parallel to the ground for several inches kicking or raking debris to the left side of the direction of travel, then they go up, over, and down to raking position again. A single rear wheel, adjustable in height, allows positive contact of the teeth with the ground but prevents the weight of the rake resting on the teeth. The teeth can be quickly straightened or replaced.

In its current stage of development the fire rake makes a clean line to mineral soil about 3½ feet in width in broadleaf fuels. All leaf litter is windrowed to the left side. The tractor and rake can operate in first, second, or third gear, and it averaged about 3 miles an hour in initial tests over moderate terrain and fairly open hardwood cover. One particularly encouraging feature was the clean line made through buckbrush and blackberry vines where the teeth had a combing action. In one test against a five-man crew with broom rakes, the tractor-drawn fire rake made three times as much fire line of comparable width and quality.

Several modifications of the pilot model have already been made in the field. The teeth have been shortened about 2 inches; stripper bars between the teeth have been removed; and the rear depth wheel has been raised. Another change to be made by the engineer is in the design and composition of the teeth. Both the tractor and rake were left on the Meramec Fire Protection District for actual use during this spring's fire season. Complete records will be kept of operation on actual fires for future detailed reports.

At the present time the fire rake offers the following advantages as a mechanical tool for fire line construction:

1. The rake and farm tractor are considerably cheaper than crawler tractors and fire plows.
2. It is adaptable to any power unit with a hydraulic lift system and power take-off (crawler tractor, power wagon, or jeep).
3. The rake merely moves the surface litter, exposing mineral soil, and does not plow a furrow that might be objectionable on some privately owned lands.
4. On a farm tractor the rake can be raised by the hydraulic lift and tractor can be roaded to fires at a speed up to 30 miles an hour.
5. The rake is light in weight and can be transported with ease on any stake truck or small trailer behind a pickup or jeep.

Although this fire rake is not yet a perfected fire fighting tool, it shows great promise and is regarded as a new principle that may eventually be used throughout the country. The rake is not yet made commercially.

A HEAVY-DUTY BROOM RAKE [1]

The most efficient hand tool used for fire suppression by Federal and State Fire Protection Agencies in the Central States of Region 9 is the heavy-duty broom rake. It is especially adaptable for use in raking or constructing fire lines in leaf fuel types on steep hillsides, in ravines and very rough terrain, and in very rocky areas where mechanized equipment cannot be used to good advantage.

The many commercial makes of broom rakes on the market were developed for use on lawns and other places relatively easy to rake. None are heavy-duty rakes that can be used dependably and effectively in an accumulation of leaves and where considerable amounts of grasses, brush, branches, and other debris are encountered. With increased forest fire protection, ground fuels become heavier and require a broom rake with a stiff spring action of the tines for clean sweeping. Also, one is required that will stand up under hard use and retain its temper after carrying burning fuel in backfiring work.

Following tests and trials of several pilot models under actual conditions, the Roscommon Fire Equipment Development Center produced a broom rake that has been accepted by experienced fire fighters as ideal for woods use. It is classed as a heavy-duty rake, but is usable for lighter work on lawns, etc. It will outperform and outlast any other rake used for fire line construction. Important features in the rake are adjustability in sweeping width; carbon steel tines that withstand heat when used for backfiring; automatic tension on tines for light or heavy going; compactness for transportation, shipping, or storage—when tines are closed the rake will fit into a small tool box or can be carried in the cab of a truck; and tines all of the same length and shape for easy replacement.

The adjustable feature of the rake permits spreading the tines to 19 inches when fully extended, and a closed width of 7 inches. The adjustment also provides a variable tension on the tines for sweeping under either difficult or easy conditions. A greater tension when tines are closed makes it easier to sweep in a heavy accumulation of leaves, branches, or other debris. With tines extended for lighter fuels the tension is lessened and the sweeping area is increased.

Another important feature of the rake, and one not usually found in lawn rakes, is the shape of the lower tine holder. The duo-directional curved shape of the holder provides a desirable sweeping position for the tines. The forward concave shape causes the outer tines to be positioned ahead of the center tines and keeps leaves from slipping off and around the sides of the rake; it also forms a "basket" for carrying burning material in backfiring work. All of the tines are in contact and level with the ground when the tool is in a position for sweeping.

The carbon steel used in the tines is more desirable than surface tempered wire, in that (a) a better and more uniform tension is provided; (b) it allows a wider range of bending and will return or spring back to normal position; (c) spring tension is not lost through heating when burning leaves are carried in backfiring; and (d) tool steel is more abrasive-resistant than other forms of wire stock and will stand up better in rocky or stony areas.

[1] Condensed from a report by E. E. Aamodt, Fire Equipment Engineer, Region 9, U. S. Forest Service.

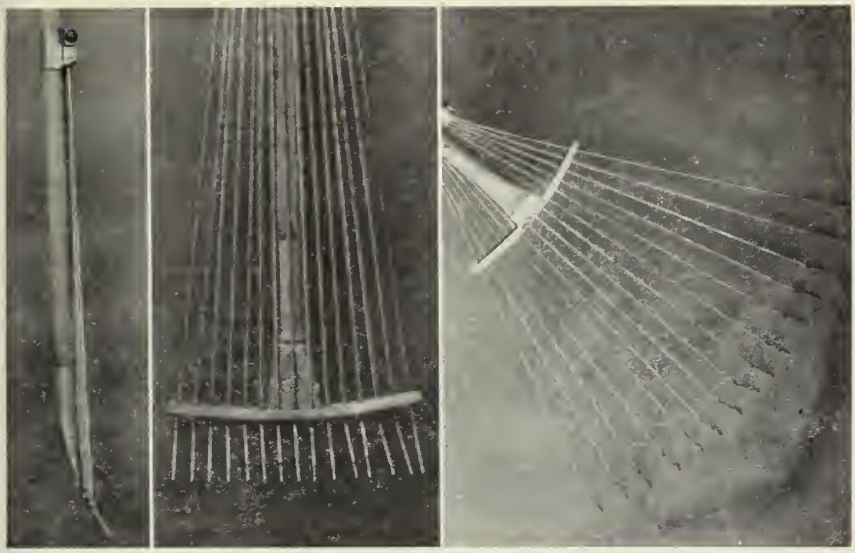

FIGURE 1.—*Left*, Side view of broom rake closed; *center*, front view of rake closed; *right*, back view of rake opened.

Figure 1 shows views of the rake. Details of its construction follow:

Handle.—Hard maple, 1 inch in diameter. Length with tines extended, 60 inches; with tines closed, 46 inches. Lower end of handle, inserted in ferrule, is straight, not tapered, to provide a better contact between metal and wood.

Sliding expansion sleeve.—A quarter-inch carriage bolt with a wing nut holds sleeve on handle and permits tine holder to slide up and down when nut is loosened.

Upper tine holder.—A bolt 3 inches long, 3/16 inch in diameter, 16-gauge cold-rolled steel, zinc plated. Upper ends of tines have completely turned eyes which loop over holder bolt and prevent tines from pulling out of place.

Lower tine holder—16-gauge, channel-shaped, cold-rolled carbon steel. Channel perforated with evenly spaced tine holes through which tines slide when rake is adjusted for width of spread.

Tines.—15, 19 inches long. Made of 11-12 gauge 1055-1065 carbon steel, zinc coated. All same length and shape; interchangeable. Lower 2 inches of each tine bent to secure best sweeping angle. Angle of bend is about 45° off horizontal; this prevents any tendency to pierce through and pick up leaves, etc., and clog the rake.

Weight.—Approximately 2 pounds, 4 ounces.

Additional information about the heavy-duty broom rake can be obtained from the Regional Forester, U. S. Forest Service, Milwaukee 3, Wis.

KNOCK-DOWN HANDLE FOR THE COUNCIL RAKE

Joseph Brishaber
District Fire Warden, Indiana Department of Conservation

Fire wardens and other conservation officers of the Indiana Department of Conservation always carry a few firefighting tools in their cars or pickups during the fire season. One of the most common tools used by fire personnel is the long-handle Council rake. This tool has always been a problem for transporting both from the standpoint of safety and storage space required. During a meeting of the Fire Equipment Development

Figure 1.—View of Council rake showing the assembled and unassembled knock-down handle. (Photo courtesy Indiana Dept. Conservation.)

Committee, the Department accepted an assignment to find a solution to this irksome problem. A knock-down handle was developed, and the rake (fig. 1) was presented for the first time at a State District Fire Wardens' Meeting last June. The rake was later exhibited at the Region 9 Equipment Development Meeting and Demonstration at Roscommon, Mich.

The simple conversion of the handle can be made as follows: Remove the handle from the metal shank. Thread the top end of the shank with a ¾-inch die after cutting 3 inches from its length. Fit a ¾-inch threaded coupling to the beveled end of the handle by screwing the handle into the coupling as far as it will go. Drill a hole through the assembled coupling and handle; rivet both pieces together by inserting a 20-penny spike through the holes. The threaded shank of the rake can then be screwed into the opposite end of the coupling, and the tool is ready for use. This simple conversion does not seem to decrease the strength of the original handle appreciably. The conversion can be readily made in any forest shop at small cost.

Helicopter Used for Fire Suppression

The Ontario Department of Lands and Forests, in co-operation with the R.C.A.F. Air Rescue Co-ordinating Centre at Trenton, Ontario, used a helicopter in suppressing an experimental fire.

The helicopter was loaded with a light pumper (Jackmite) and a 25-gallon drum of water. The pumper was operated while the helicopter hovered over the test fire which was approximately twenty feet in diameter. It was found that:

(a) the downdraft of the helicopter rekindled the fire

(b) the discharge of the pumper could be directed but was shattered by the helicopter downdraft

(c) the 25-gallon drum, emptied in approximately three minutes, effectively doused the whole fire; only a few of the larger pieces of the wood remained smouldering.—(Report on Forest Fire Research in Canada, July, 1949 to July, 1950, Canadian Society of Forest Engineers.) From Forest Fire Protection Abstracts. Canada Dept. Resources and Devlmt. 2:12. 1951.

Plastic-Impregnated Maps

The Lower Ottawa Forest Protective Association has been experimenting with fire tower maps which had been impregnated with a plastic before use. The maps so treated may be written on without marring the surface, and are said to be practically indestructible.

These maps were treated in 1950 at a cost of about $6.00 each.—(Proceedings of the Fourth Meeting, Sub-committee on Forest Fire Research, Associate Committee on Forestry, February, 1951.) From Forest Fire Protection Abstracts. Canada Dept. Resources and Devlmt. 2:21. 1951.

CANTEEN CARRIER

WREX K. HAUTH
Forestry Aid, Mark Twain National Forest

A device for carrying 1-gallon canteens on stake trucks or pickups equipped with side racks has been developed and put in use on the Mark Twain National Forest. The carrier provides a safe and handy place for canteens, and is out of the way of other cargo or passengers being trans-

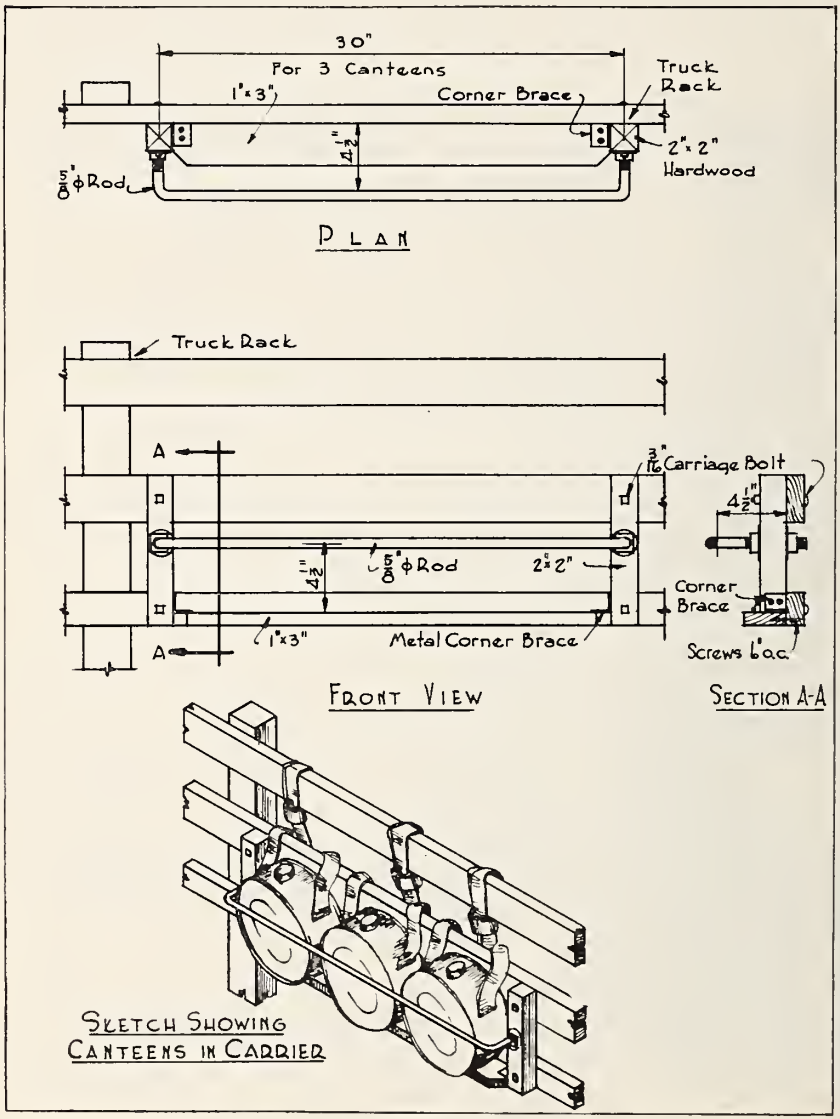

FIGURE 1.—Canteen carrier for truck rack.

ported in the vehicle. It also prevents damage to the paint job of the truck, and excessive wear on the canteens, such as that caused by swinging from the truck rack, rear-view mirror, or cab door handle.

The carrier is made of 1- by 3-inch lumber and a ⅝-inch steel rod mounted on two 2- by 2-inch pieces of wood fastened to the side rack of stake or pickup trucks (fig. 1). Assembly is as follows:

Step 1.—Bolt 2- by 2-inch hardwood uprights to rack of truck with 5/16- by 3½-inch carriage bolts, in a vertical position. Bottom ends of uprights may need to be beveled to fit flare of truck bed on pickup trucks.

Step 2.—Fasten 1- by 3-inch piece of lumber horizontally to side of truck rack and in a position between uprights so that it will support bottoms of canteens.

Step 3.—Drill one ⅝-inch hole through each upright 5 inches above top of the 1- by 3-inch horizontal piece. This will place the supporting rod mentioned in Step 4 approximately in center of canteens.

Step 4.—Bend ⅝-inch rod at right angle approximately 5½ inches from each end. This will allow about 5½ inches on each end of the rod to be inserted in the ⅝-inch holes drilled in the uprights. Place one ⅝-inch nut and flat washer on each end of the rod. Insert ends of rod through ⅝-inch holes in uprights and place another nut and washer on ends of the rod. Four inches of thread on each end of the rod will allow adjustment to fit thickness of the canteens. The length of the rod and the spacing of the uprights will depend upon the number of canteens to be carried. A 44-inch rod will accommodate three 1-gallon canteens.

Wright Hose Vulcanizer

The Forestry Branch has developed a vulcanizing device which will produce patches and splices capable of withstanding pressures exceeding 200 pounds per square inch.

One of the important features of the unit is that it produces a splice which lies flat when not under pressure so that the hose may be rolled or folded with practically no increase in bulk.

Splices may be made for approximately 75 cents each and patches for considerably less, depending on the type of patch necessary. This estimate is based on the cost of materials and labour in 1949.

Detailed information on the machine may be obtained by writing the Director, Forestry Branch, Department of Resources and Development, Ottawa.—From Forest Fire Protection Abstracts. Canada Dept. Resources and Devlmt. 1:23. 1950.

INITIAL FIRE REPORT FORM, REGION 4

Francis W. Woods
Communications Officer, Region 4, U. S. Forest Service

A few years ago it became apparent that there existed a real need to streamline our initial fire report form. Reports should—

1. Be usable Region-wide.
2. Be usable both by the lookout and the dispatcher, and permit the dispatcher to record his fire and follow-up actions on the same form.
3. Be easily understood and readily filled out with as little writing as possible.
4. Carry essential information arranged in logical order.
5. Be easily read.
6. Be designed so that when bound, either on the side or top of the sheet, all essential data will be out in the open.

The report shown in figure 1 is the result of suggestions from all of Region 4's forests and is based on one field season's use. The example below illustrates its application.

In use the lookout would fill in Line 1, preferably ahead of time. He probably would fill in a dozen or so sheets. When a fire is seen he fills in Lines 2 and 3. (In Line 2, use 24-hr. time. Example: 12:30 a.m.=0030; 8 a.m.=0800; 3:00 p.m.=1500.) On Line 4 he circles the appropriate word. On Line 5 he fills in the first three items and circles the appropriate quarter section. On Lines 6 through 11 he circles the appropriate word, fills in Line 12, and calls the dispatcher.

In the following example of a radio report, the dispatcher is located at Salmon. The lookout is Long Tom. 10-80 is Region 4 fire emergency code. The dispatcher would use a check mark wherever appropriate in filling out the form. Example:

Lookout calls: Salmon, Long Tom, Over.

Dispatcher answers: Long Tom, Salmon, Over.

Lookout says: 10-80; 2 - 220; 3 - Head of Long Gulch; 4 - Yes; 5 - 6N, 7E, 36SE; 6 - South; 7 - Grey; 8 - Grass; 9 - North; 10 - Calm; 11 - Spot; 12 - North along Long Gulch trail. Over.

Dispatcher says: 10-4.

A call takes less than 30 seconds—less writing by both the lookout and dispatcher. There is no conversational type contact. Such a system of reporting is capable of handling 30 to 40 fire reports in 15 to 25 minutes.

In the event the dispatcher missed out on a part of the report, (Line 8 for example) he would ask for a repeat thus: "10-9, Line 8." The lookout would use the one word, "grass" Over. The dispatcher would say "10-4, Salmon Out." 10-9 in this case is Region 4 code for "Please repeat from." If the situation warranted, the lookout would spell grass thus: "George, Roger, Able, Sugar, Sugar; Over."

Note: Use 24 hr. time example: 12:30 a.m. = 0030; 8:00 a.m. = 0800; 3:00 p.m. = 1500.

After Fill-in Transmit Report As Follows (Key in 1-):

LOOKOUT SAYS: Salmon - Long Tom - Over

DISPATCHER SAYS: Long Tom - Salmon - Over

LOOKOUT SAYS: 1080; 2-220; 3-head of Long Gulch; 4-yes; 5-GN -- 7E -- 30 -- SE; 6-South; 7-Grey; 8-Grass; 9-North; 10-Gale; 11-Spot; 12-North along Long Gulch Trail. OVER.

INITIAL R-4 FIRE REPORT

LOOKOUT FILL IN

FILL IN OR CIRCLE

1	LOOKOUT: ON NF REPORT TO
2	AZIMUTH: DATE TIME
3	LOCATION: BY LANDMARKS:
4	IS SMOKE BASE SEEN?: YES NO QUESTIONABLE
5	MAP LOCATION: T. R. SEC. 1/4 SEC. NE. SE. SW NW
6	SLOPE FACES: N. NE. E. SE. S. SW W. NW
7	SMOKE COLOR: BLACK GREY WHITE BROWN BLUE REDDISH
8	BURNING IN: SINGLE TREE, GRASS, BRUSH, GREEN TIMBER, OLD BURN, 2ND GROWTH, CUT OVER
9	SMOKE DRIFTING FROM: NORTH NE EAST SE SOUTH SW WEST NW
10	WIND VELOCITY: CALM, V LIGHT, LIGHT, GENTLE, MODERATE, FRESH, STRONG
11	SIZE IN ACRES: SPOT, 1/4, 1/2, 3/4, 1, 2, 5, 10, OVER 10.
12	BEST ROUTE TO FIRE:

NOW CALL DISPATCHER

DISPATCHER ACTION: READINGS FROM OTHER LOOKOUTS

IF YOU GO TO FIRE TAKE THIS FORM WITH YOU

13	LOOKOUT: AZIMUTH TIME SMOKE BASE SEEN – NOT SEEN
14	REMARKS:
15	LOOKOUT: AZIMUTH TIME SMOKE BASE SEEN – NOT SEEN
16	REMARKS:
17	LOOKOUT: AZIMUTH TIME SMOKE BASE SEEN – NOT SEEN
18	REMARKS:
19	FINAL LOCATION: TWP. RANGE SEC. 1/4 SEC.
20	DISPATCHED FROM: FOREMAN NO. MEN
21	DATE: TIME: TRAVEL BY: FOOT, HORSE, AUTO, PLANE, COPTER
22	TRAVEL ROUTE:
23	EXPECTED ARRIVAL TIME INITIAL ATTACK FORCE: DATE TIME
24	SPECIAL EQUIPMENT:
25	FOLLOW UP ACTION: DATE TIME SUPERVISORS FIRE NO.
26	FIRE NAME

FORM 19 R4
AGRICULTURE - OGDEN

FIGURE 1.

A TIMETABLE FOR LARGE FIRE MANAGEMENT

Byron Beattie
Forest Supervisor, Sierra National Forest

Rapid initial attack, calculation of fire location by specific periods, crews on the line by daybreak, tactical plans to coincide with diurnal variations in fire weather—these are some of the time factors characterizing fire suppression operations. These and comparable tactical time factors have been repeatedly stressed in fire literature, in fire training plans, and in fire boards of review. They are, therefore, common knowledge and accepted principles of strategic, tactical, and operational fire suppression within the ranks of fire overhead personnel.

Why then does the record of large fire suppression reflect in case after case the failure to realize such well-recognized tactical timings in vital suppression actions? What are the reasons behind unattained tactical timing? And what can be done to help the men on the job—the Fire Boss and his staff—bring about tactical timing?

In considering the reasons for failure in tactical timing one usually finds the Fire Boss reporting: (1) The day shift resources didn't arrive in time; (2) the fire camp was not fully set up and we couldn't get men out in time; (3) we didn't get our plans and instructions prepared in time; (4) we spent too much time on strategy and didn't get around to activating a plan of control. We didn't realize it was so late, and finally . . . ; (5) there just wasn't time enough to do everything.

Behind the lines, where manpower and material must be mobilized and dispatched, the report usually is that orders were incomplete, or orders were received too late.

Certainly, anyone who has been involved in managing a large free-burning fire realizes that under such stress it is common to lose all concept of time and to become involved in an endless and time-consuming chain of tasks and decisions. Inevitably, the deadline for action arrives. The result? A timetable of service functions impossible of attainment, hurriedly made decisions of major import and, eventually, a poorly instructed, haphazardly equipped line force that arrives on the line much later than had been planned.

In an effort to focus attention on the preliminaries essential to attainment of tactical timing and to guide fire management in prorating their available time to all functions of management, a timetable was developed. In practice, it has been successful.

Intelligent understanding and application of the timetable must recognize the following:

1. It is a guide. Times are not absolute and may vary by individual operations. However, all fires and/or divisions operating under a single General Headquarters must adhere to the master schedule of Headquarters.
2. Adherence to schedule requires that subordinate officers be provided with and comply with a schedule of accomplishment, correlated with that of fire management.

DIVISION OR SINGLE FIRE HEADQUARTERS TIMETABLE

Hour	Fire boss	Plans chief	Service chief	Line boss
Origin	1. Review of available information. 2. Review of Line Boss plan (Incl. Reconn. or study) and confirmation or adjust. 3. Compute spread and probable duration of fire. 4. Compute 2d day control force requirements. 5. Select base of operation. 6. Place 2d day orders. 7. Organization and supervision, with emphasis on plans and service functions.	1. Reconn. and/or problem study. 2. Work with Fire Boss or independently on calculation of probabilities and control force requirements for 2d day (detailed). 3. Initiate 1st night intelligence. 4. Organize and supervise plans unit.	1. Compute, order, place in operating condition service needs. 2. Study base to fire line access and travel times. 3. Organize and supervise service unit.	1. Review - analyze available information on fire. 2. Enroute to fire secure vantage point size up. 3. Prepare initial plan of control (through 1st night) and notify dispatcher of the situation; control force required. Mobilization point (complete within 30 minutes). 4. Organize and supervise line action until relieved.
7P				
7P-9P	Joint planning and decision—2d day shift operation			
9P-11P	Supervision with emphasis on plans and service.	Detailed instructions day shift. Bring records up to date.	Preparation for morning dispatch.	
11P-3A	Off duty. Available for decision.	Off duty.	Off duty.	
3A-3½A	Review of night intelligence; minor adjustment of plans and instructions.		Final check dispatch preparedness.	
	Line overheard breakfast 3 to 3:15; crew boss and manpower 3:15 to 3:45.		Dispatch line forces.	
3½A-4A	Brief line overhead.			Change of shift.
4A-5A	Breakfast			
5A-6A	Night shift overhead interrogation/24-hr. service needs.			Line supervision.
6A-8A	Progress report and 24-hour plan of control.		Night shift service preparation.	Critical-sector supervision.
8A-10A	Field reconn. Night shift plans.	Night shift plans.		Calm-sector supervision.
10A-1P	Off Duty.			
1P-3P	Field reconn. and supervision—free lance.	Reconn. - supervision of plans unit. Detail instructions for night shift.	Service unit supervision—Field reconn.	Critical-sector supervision and general correlation of all sectors until relieved
3P-4P	Review of day intelligence reports. Minor adjustments of plans and instructions.		Final check night dispatch arrangements.	
	Line overhead supper 3:30-3:45; crew boss and manpower supper 3:45-4:15.			
4P-4½P	Brief line overhead.		Dispatch line forces.	Change of shift.
4½P-6P	Off Duty.			
6P-7P	Day overhead interrogation.		Initiate day shift service arrangements.	Line supervision.
7P-9P	Prepare plans and instructions, next day shift. Joint planning and decision 3d day shift operation.			Line supervision.
9P-3A	Off duty.			

GENERAL FIRE HEADQUARTERS TIMETABLE

DAY OF ORIGIN

Hour	Fire boss	Chief of staff	Plans chief	Service chief
Origin	1. Initiate mobilization of G.F.H. 2. Observation or study of fire problems. 3. Check calculation of fire probability and control force requirements.	On the ground assistance to Division Fire Boss. 1. Probabilities. 2. Control force requirements. 3. Organization of division forces.	Work with Fire Boss or independently on: 1. Observation or study of fire problems. 2. Check calculation of fire probability and control force requirements.	Procurement and delivery of division's anticipated needs for 2d and 3d shifts.

SUBSEQUENT 24-HR. PERIODS

9P-11P	Staff conference—review of situation; action-plan next 24 hours.			
11P-5A	Off duty			
5A-9A	Field reconn. and consultation.	Field reconn. and consultation.	Field reconn.	Mobilization and delivery of Divisional needs. Observe mobilization plans and/or demobilization plans.
9A-Noon	Joint review of division's 24-hour plan of control; Division notification and Headquarters action plan.			
Noon-7P	Free of operational duties, available for decision.	Field liaison and counsel.	Check calculations emergency or disaster plans.	Same as a. m. plus trouble shooting.
7P-8P	Joint conference and plans.			
8P-5A	Off duty. Available if needed.			

3. Fire management must base 2d day decision, plans and action on available information. Unless the 7 p. m. day-of-origin deadline is met, tactical timing fails.

4. First-night rest must be secured as indicated to avoid a sluggish and mentally dull management team.

5. Cold-blooded organizational discipline and self-descipline is a must.

6. Items shown in the timetable are only key factors of position requirement.

As implied above, field fire management must recognize the existence of a behind-the-lines organization which may be limited to a forest fire control officer who functions as chief of staff, and a supply or procurement officer. However simple the organization, it should be established and function as General Fire Headquarters. The field operation then becomes a Division, and field management functions as a Division Fire Headquarters.

Locally, we have found that this provides the tie between the going fire and behind-the-lines recruitment, and sets the stage for expanding from the single-fire to the multiple-fire operation.

FIRE PREVENTION PROGRAM ON KIAMICHI RANGER DISTRICT

D. D. Devet
District Ranger, Ouachita National Forest

HISTORY

The Kiamichi Ranger District of the Ouachita National Forest is located in Oklahoma. It has a protection area of 257,463 acres with a net U. S. land area of 180,313 acres. Since 1939, the number of annual forest fires has varied considerably—84 occurred in 1950, and only 8 in 1945. During the same period, the percent of annual burn has varied from 3.24 in 1943 to 0.01 in 1944.

North and west of the district, there is no organized protection; local residents burn at will and State fire laws are ignored. South of the district, the Oklahoma Division of Forestry and Parks is providing protection for State and private land. Much of the timberland outside the forest is held by absentee owners who provide little or no protection for their properties.

An analysis of the causes of 562 fires on the district during the years 1939-51 indicates the following:

Cause	*Percent of total fires*
Lightning	10.3
Railroad	7.8
Lumbering	1.6
Smoker	19.8
Debris burning	4.3
Incendiary	38.8
Campfire	5.3
Miscellaneous	12.1

PATTERN OF BURNING

More than 1,500 families live adjacent to or within the Kiamichi Ranger District. The tradition of open range woods burning in the spring still prevails, and an analysis of incendiary fires revealed the following reasons for burning: (1) To improve grazing. (2) To reduce hardwood undergrowth in order to: increase visibility for hunting; make woods riding easier; remove briars; kill ticks and snakes; make locating hogs and cows easier; improve visibility in general. (3) Job fires. (4) Spite against neighbor, warden, or lookout. (5) Cattle concentration burn for roundup. (6) Turkey burn. (7) Want of excitement while intoxicated. (8) Just like to see the woods burn.

ORGANIZING THE PREVENTION PROGRAM

During the summer of 1951, it was concluded that ordinary prevention efforts were not obtaining the desired results. An intensive program was therefore developed with plans to follow it for 3 or 4 years. Most of the Kiamichi Ranger District residents realize that wild forest fires are damaging to their interests in the long run, and routine prevention efforts in

general suffice to reach them. Scattered throughout the district, however, are a few individuals who believe that an annual burning of the woods benefits their interests. The objective of the intensive prevention efforts was to reach these individuals.

Analysis of the situation and development of the prevention program involved the following steps:

1. The entire ranger district was divided into problem areas where a characteristic pattern of fires occurred each year. For instance, in one area there are usually one or two Class E multiple-set incendiary grazing fires annually. In another, debris burning is the main problem. In a different area, hunters who leave burning hollow trees and campfires are the principal cause of fires. In still another area, job fires occur frequently. Thus, the individual problem areas were defined.
2. The second step taken was to list those individuals likely to have been responsible for the fires in each problem area.
3. Finally, each individual suspect was studied closely for his habits, source of livelihood, companions, weaknesses, reasons for causing the fires, the people he respects and whose advice he follows, and his relatives. An avenue of approach was studied for each suspected group of incendiaries.

PREVENTIVE ACTION

With the analysis completed, a course of action was decided upon. Personal contact was chosen as one of the most effective prevention media. The first step is to get well acquainted with each of the suspected incendiaries to try to gain his confidence and friendship. A different approach is used for each individual based on a study of his habits, personality, and attitudes. For instance, incendiaries suspected of setting range fires to improve grazing are accompanied into the woods range. While crossing areas burned by wild forest fires, attention is called to the prolific sprouting of hardwood brush as a result of fires, and how the brush is choking out the forage. On adjacent unburned areas, the greater abundance of forage and less dense hardwood underbrush is noted. It is explained how spring fires cause a large number of sprouts to originate from each stem of hardwood burned. To provide better forage, the cattle owners are encouraged to investigate the possibilities of improved, fenced pastures. In order to meet the cattlemen on equal terms, cattle breeds, range conditions, pasture management, and local range problems are studied with the advice and assistance of the county agent.

Arrangements are made to go on coon or possum hunts with hunters suspected of leaving warming fires and smoking hollow trees. While on the hunt, the correct method of putting out warming fires and fires used to smoke game out of hollow trees is demonstrated.

Soil-tilling methods, fertilizers, and the use of ammate and other chemical means of brush and broom sedge control are discussed with debris and field burners. When burning cannot be discouraged, correct burning techniques are explained and demonstrated.

In areas where job fires are suspected, the possibility of new industries is investigated. For instance, broiler raising is studied and information on this disseminated. In order to keep the residents occupied and to demonstrate the value of the timber crop, effort is made to increase the

number of sales of timber products in these areas. Information on employment possibilities is passed on to idle residents of these communities.

Thus, through understanding, guidance, and education, personal contact work is conducted among the minority suspected of being responsible for most of the man-caused fires. Each individual presents a new problem that requires a different approach.

Another contact approach is the marshalling of public opinion against man-caused forest fires. This is done through becoming acquainted with the most influential members of each community. By showing these leaders the damage done by wild forest fires, it is possible to build up indirect pressure against the intentional setting of uncontrolled fires. Another prevention tool used is the local newspapers. Every week the two local papers covering the district publish a short column entitled Your Forest Service. This column attempts to bring a realization to all forest residents that they have a personal stake in the activities and management of the national forest in Oklahoma. The column covers various activities of the district with emphasis on fire prevention.

Facilities of the local radio station are also utilized. Each month one or two 15-minute broadcasts are made by Forest Service personnel in cooperation with the county agricultural agent. These broadcasts are released over a radio station whose beams reach a majority of district residents. Activities covered in these broadcasts are closely tied in with fire prevention. In addition to these programs, the county agent, who has a program of his own called On the Farm Front, frequently inserts fire prevention ideas in his broadcasts.

Advantage is taken of every opportunity to show movies and slides, and to give lectures to schools, veteran classes, clubs, and churches. Through this means, better relations are cultivated with teachers, veteran vocational advisers, club leaders, and ministers, all of whom help formulate public opinion. Show-me trips are also used to advantage. They are the best way to show the loss to the community caused by forest fires and the rapid growth of pine timber on unburned areas.

A thorough and prompt investigation of all man-caused fires is a must. Sometimes the investigation is made in the company of a local, well-known law enforcement officer; this may have a beneficial psychological influence. All employees of the ranger district are trained to help carry out the prevention program, and each acts as a prevention man in his own sphere of influence.

The fire statistics for the next few years will tell whether the Kiamichi fire prevention program has succeeded or failed. Although the results will be slow in showing up, the reaction from local residents indicates that some progress has already been made.

FIRES BY THE DOZEN

Ralph C. Bangsberg
Fire Control Officer, Shasta National Forest

Monday morning, July 24, 1950, was just another day at the Supervisor's Office on the Shasta National Forest. Nothing very outstanding in the way of a day so far as fire control was concerned. Forest Dispatcher Adams had informed the fire control officer of the weather forecast which involved little or no change from the day before. Fire danger in the high bracket.

The morning wore on with "business as usual." The weather man was pretty close to right. It *was* getting hot and a good breeze was coming from the south; it looked as though we were in for a warm afternoon.

The quiet was suddenly interrupted by the startling blast of the Mt. Shasta city fire siren. Someone had a fire! By phone from Dispatcher Adams it was learned that a defective steam engine on the Southern Pacific Lines had left Black Butte station some 8 miles north of Mount Shasta city and was traveling south setting what looked like dozens of fires along the right-of-way. It had just gone through the city, a distance of more than a mile, and had left at least 10 or 11 smokes. Efforts were being made to stop the engine as soon as possible.

Just how many fires there were out on the forest could not be learned at first. There was plenty for all and it was "all hands on deck." It wasn't hard to find a fire and any number of small grass fires, some too small to count, were extinguished on the run—knock down one and run to the next.

It all looked like a hopeless confused mess at first, but soon the steady pressure of a well-trained and determined fire organization began to show. From 11:40 a. m. until 1:00 p. m., an interval of 1 hour and 20 minutes, at least 16 fires were reported spread out over a distance of about 17 miles. Add to this the 11 fires within the city limits of Mt. Shasta and you have a picture of the alarming situation confronting the fire fighting organization.

Success in handling such a string of fires in dry grass and brush in the middle of a hot July day doesn't just "happen." It should be noted that the defective engine was stopped, but not before it could set five small fires close together in the bottom of the rugged Sacramento Canyon. All other fires were handled and kept to Class A or B. The five fires on the steep slopes of the canyon quickly ran together and produced the one large Class D fire.

The summary chart shows three separate tanker crews and the FCA dispatched to fires, and behind this organization there was one lookout able to see the entire string of fires, a Forest dispatcher and a Ranger District fire dispatcher. Linking this entire organization together was a complete net of mobile two-day radio. Each unit—dispatchers, lookouts, and attacking forces—was 100 percent equipped. The drama of what happened and how it happened is difficult to detail.

SUMMARY OF FIRE BUST
OF JULY 24, 1950

Fire No.	Time discovered	Controlled	Elapsed time	Size class	Crews handling	First report
1	11:40	12:10	0:30	A	So. Yard	Initial dispatch
2	11:46	12:05	0:19	A	Weed	do.
3	11:47	12:16	0:29	B(3 acres)	do.	Reported en route
4	11:57	12:10	0:13	A	Castella	Initial dispatch
5	11:57	12:15	0:18	A	do.	Reported en route
6	11:57	12:30	0:33	A	do.	do.
7	12:00	12:15	0:15	A	Patrolman	Initial dispatch
8	12:08	1:00	0:52	B (.9 acre)	Weed	Reported en route
9	12:15	12:30	0:15	A	FC Assist.	do.
10	12:15	12:40	0:25	A	do.	do.
11 (5 fires)	12:30	7/25 2 a.m.	13:30	D (130 acres)	All crews	do.
12	1:00	1:50	0:50	A	So. Yard	do.
13	2:43	3:10	0:27	A	Castella	do.
14 (11 fires in city; handled by city)	...	...	...	A's	City	

Note: All times daylight saving.

The lookout reporting fires to the district dispatcher and directing crews into smokes. The district dispatcher sending crews to new fires the moment they controlled their present smoke. The crews reporting their progress and asking for new assignments. The lookout again reporting on the seriousness of old or new smokes. The forest dispatcher calling in other mobile field units from other districts, holding them here, turning them around to stand-by at other locations, directing their entry to the fire zone, etc. The district dispatcher directing and receiving reports from scout cars. All of this wove itself into a pattern that snuffed out the seemingly endless string of fires one by one until at last all fires were controlled except the large one in the canyon. As the crews were freed from the smaller fires, they were directed to the one remaining large fire, eventually converging upon it and we might add—none too soon.

Anything slower than the instant medium of radio would have delayed the attack on other fires. The result would no doubt have been nothing short of catastrophe.

Tankers, crews, tractors and men converged on the now rather savage brush fire that had come up out of the canyon and was making a bid to the dubious fame of becoming a very large and destructive brush fire. Houses, an airport, heavy traffic on U S 99, and timber all stood in its direct path. It *had* to be stopped at the one remaining barrier, the railroad tracks.

Tankers shoved into the fight, directed by observers in radio cars, and picked spot fires as fast as they came. Not one less than the four or five tankers used in this spot fire attack would have been enough. They had to be there, and able to move from spot to spot as directed by radio—and fast!

Time was of the essence as was complete coordination by those directing operations. It is safe to say that the cost of the radios used in this day's operation was insignificant compared to the money they saved in directing the attacking equipment and men.

Can you picture what might have happened if the crews had to depend upon hunting up a telephone to make their report after each fire or seeing another fire, rushing to it, only to find that two other crews had done the same, while other more serious fires burned unattended?

The city of Mt. Shasta experienced in a small way what could have happened. Our lookout on Black Butte gave the dispatcher information that there were three fires in the north end of the city. The dispatcher notified the city fire department. Immediately they sent their three trucks to these fires. In a few minutes seven or eight more fires were reported in the city limits. Frantic calls flooded their dispatch center. The situation was finally handled through the aid of messenger service, local volunteers, police cars, and others. Obviously, with many people at hand and short distances, such a difficulty can soon be overcome, but not so with widely scattered fires in isolated areas.

Paper for Covering Piled Slash

The kind of paper to use for covering piled slash, as reported in the July 1951 issue of Fire Control Notes, is referred to in the trade as "counter rolls." It is waterproofed kraft building paper, laminated 30-30-30, 9 inches in diameter, uncreped, not reinforced, class C. It is sold by the pound. A 48-inch wide roll weighs approximately 76 pounds, contains 2400 square feet, and costs about $10 per hundredweight. Its principal use is for lining the holds of ships.—Division of Fire Control, *Region 6, U. S. Forest Service.*

INFORMATION FOR CONTRIBUTORS

It is requested that all contributions be submitted in dnplicate, typed double space, and with no paragraphs breaking over to the next page.

The title of the article should he typed in capitals at the top of the first page, and immediately underneath it should appear the author's name, position, and unit.

Any introdnctory or explanatory information should not he included in the hody of the article, bnt should he stated in the letter of transmittal.

Illnstrations, whether drawings or photographs, should have clear detail and tell a story. Only glossy prints are acceptahle. Legends for illustrations should be typed in the manuscript immediately following the paragraph in which the illustration is first mentioned, the legend heing separated from the text by lines hoth ahove and below. Illustrations should be laheled "figures" and numhered consecntively. All diagrams should be drawn with the type page proportions in mind, and lettered so as to permit reduction. In mailing, illustrations should he placed hetween cardboards held together with rubher hands. *Paper clips should never be used.*

When Forest Service photographs are submitted, the negative number should he indicated with the legend to aid in later identification of the illustrations. When pictures do not carry Forest Service numhers, the source of the picture should be given, so that the negative may be located if it is desired.

India ink line drawings will reprodnce properly, but no prints (black-line prints or blueprints) will give clear reproduction. Please therefore submit well-drawn tracings instead of prints.


REMEMBER – ONLY YOU CAN
SMOKEY
PREVENT
FOREST
FIRES!

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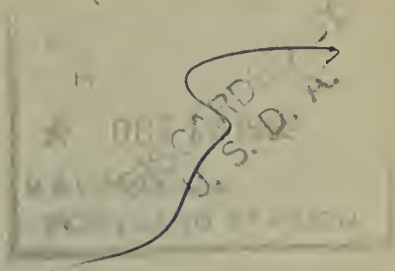
FIRE CONTROL NOTES



A PERIODICAL DEVOTED TO THE TECHNIQUE OF FOREST FIRE CONTROL

FOREST SERVICE • U. S. DEPARTMENT OF AGRICULTURE

FORESTRY cannot restore the American heritage of natural resources if the appalling wastage by fire continues. This publication will serve as a channel through which creative developments in management and techniques may be communicated to and from every worker in the field of forest fire control.

Volume 13 Number 4

FIRE CONTROL NOTES

A Quarterly Periodical Devoted to the TECHNIQUE OF FOREST FIRE CONTROL

The value of this publication will be determined by what Federal, State, and other public agencies, and private companies and individuals contribute out of their experience and research. The types of articles and notes that will be published will deal with fire research or fire control management: Theory, relationships, prevention, equipment, detection, communication, transportation, cooperation, planning, organization, training, fire fighting, methods of reporting, and statistical systems. Space limitations require that articles be kept as brief as the nature of the subject matter will permit.

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CONTENTS

SMOKEY THE BEAR

J. Morgan Smith
Assistant Director, Cooperative Forest Fire Prevention Campaign [1]

Smokey, the forest fire preventin' bear, has finally achieved stardom. Like other celebrities, he was recently featured in color on the front cover of Newsweek magazine. This same issue carried an excellent story on Smokey and forest conservation which said, "America's best animal friend is a sturdy brown bear named Smokey. Not since the early days of Mickey Mouse and Bambi has any cartooned animal made such an impact on Americans. And the story of how Smokey was born and how he grew is a prize example of wholesome and energetic cooperation between government and business." This was the longest story ever carried in Newsweek.

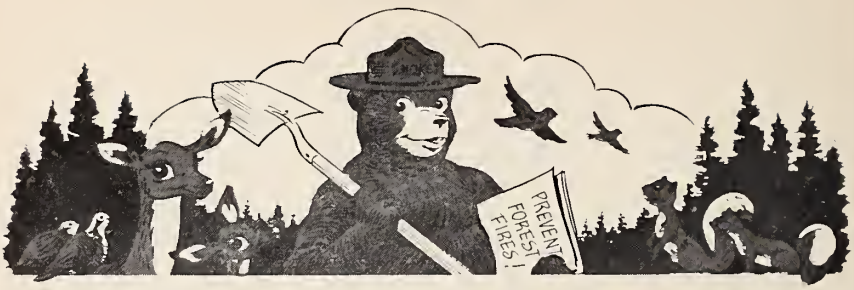
Several weeks ago, President Truman signed a bill which prevents Smokey from being used in any manner that would be detrimental to his work in forest fire prevention. This marked the first time in history that the Congress of the United States had enacted legislation to protect an animal character from misuse.

Smokey The Bear is the name of a new song which you will soon be hearing on radio, television, and "juke" boxes and in motion picture theaters throughout the land (fig. 1). It was written by two topflight Hollywood song writers, Steve Nelson and Jack Rollins, and tells in entertaining fashion the story of Smokey and the work he is doing in educating the American public to the danger of forest fires. Eddy Arnold introduced the song in a new 4½-minute film Smokey The Bear, which has been released to television stations and motion picture theaters. Gene Autry has recorded the song for Columbia Records, and other leading companies are lining up their top vocalists to do the same.

As the result of Smokey's growing popularity, MGM is now working on a Smokey cartoon feature. Other companies have requested licenses to manufacture Smokey Bear products such as dolls, toys, ash trays, belts, hats, ties, etc. Several leading publishing companies want to put out books on Smokey.

Yes, Smokey has come a long way since he was created in 1945, by the advertising agency, Foote, Cone & Belding, as a symbol which would help focus public attention on the Nation's forest fire problem. Since 1947, Smokey has appeared regularly on posters, car cards, blotters, and other material provided through the Nation-wide Cooperative Forest Fire Prevention Campaign which is sponsored by The Advertising Council and conducted by the State Foresters and the U.S. Forest Service. The Advertising Council is a nonprofit business organization created to help solve

[1] Sponsored by State Foresters and U.S. Forest Service.



SMOKEY THE BEAR

By STEVE NELSON and JACK ROLLINS

1. With a Ranger's hat and shovel and a pair of dungar-ees you will find him in the forest always sniffin' at the breeze. People
2. You can take a tip from Smokey that there's nothin' like a tree, cause they're good for kids to climb in and they're beaut-i-ful to see, you just
3. You can camp upon his doorstep and he'll make you feel at home, you can run and hunt and ramble any - where you care to roam. He will
4. If you've ever seen the forest when a fire is running wild, and you love the things within it like a moth-er loves her child, then you

stop and pay at-ten-tion when he tells 'em to be- ware, 'cause ev'-ry - bo-dy knows that he's the Fire Pre- ventin' Bear.
have to look a-round you and you'll find it's not a joke, to see what you'd be mis-sin' if they all went up in smoke.
let you take his hon-ey and pre- tend he's not so smart, but don't you harm his trees for he's a Ran-ger in his heart.
know why Smok-ey tells you when he sees you pass-ing through, "Re- member... please be care-ful... its the least that you can do."

Smokey - the Bear, Smokey - the Bear. Prowlin' and a growlin' and a sniffin' - the air. He can find a fire - before it starts to flame. That's why they call him Smokey, that was how he got his name.

Illustrated by RUDOLPH WENDELIN

FIGURE 1.

national problems through education by use of various advertising media. Besides Forest Fire Prevention, the Council sponsors other campaigns in the public interest such as Stop Accidents, Red Cross, Better Schools, Care, U.S. Defense Bonds, and Fight Inflation. All of its services are free.

The phenomenal growth of Smokey into a national character

has been due in no small measure to the splendid support which business and industry have given the campaign since its inception in 1942. Last year, through The Advertising Council, over 6 million dollars worth of free advertising time and space was donated to the campaign by American business. For example, in 1951, the transportation advertising industry gave space for the entire months of April and September for display of approximately 100,000 Smokey car cards in busses, streetcars, subways, ferries, and railroads throughout the Nation. An estimated 50 million riders saw these forest fire prevention messages. The space and the labor involved in putting up and taking down the cards were absolutely free. This one contribution alone had an estimated value in excess of $500,000. The advertising firm of Foote, Cone & Belding has had direct charge of Smokey since his birth. Each year, Foote, Cone & Belding puts into the job more than $35,000 of time and effort, at no cost to the Campaign.

Besides business, the American Red Cross, Boy Scouts, Girl Scouts, Camp Fire Girls, and numerous other organizations have supported the campaign in splendid fashion.

Another important factor that has aided tremendously in developing public recognition of Smokey as the Nation-wide symbol for forest fire prevention was the discovery of a real live Smokey about 2 years ago in New Mexico. At that time, the only survivor of a disastrous 17,000-acre, man-caused forest fire was a frightened, badly burned cub bear. The Associated Press' photo, showing the pathetic looking cub having his burned paws bandaged by a doctor, was flashed across the Nation. It appeared on the front page of leading newspapers everywhere and created genuine interest and sympathy on the part of the American public in this forest fire orphan. Overnight he became famous. They named him Smokey, after his mythical brother, the poster Smokey.

Under the expert care of New Mexico game wardens, he was gradually nursed back to health. Then, New Mexico State Game Warden Elliott Barker decided that "Little Smokey" had a definite mission in life and that was to serve as a living reminder to people everywhere of the constant need for care with fire when in our forests and woods. So, one day, after complete recovery from his burns, Smokey crawled aboard his private plane, a Piper Cub, and took off for Washington, D.C., to take up permanent residence there.

His arrival in the Nation's Capital was greeted with great fanfare. He was received in the Presidential Room of the National Airport. Little Smokey appeared on television, in motion pictures, and in parades. Finally, in appropriate ceremonies at the National Zoo, he was presented to the school children of America and today is the living symbol of forest fire prevention and wildlife conservation.

Men, women, and children from all parts of the country come to see the live Smokey. Dr. William Mann, Director of the National Zoo, says that Smokey is the most popular animal in his

collection. He is an honorary member of such organizations as the AAA's School Safety Patrol System and the Washington, D.C., Fire Department. Hopalong Cassidy is one of the many well-known personalities who has called on Smokey.

Little Smokey is no longer a cub. He weighs in the neighborhood of 200 pounds and his fur is a beautiful cinnamon brown. He is now the official model for all posters furnished by the Nation-wide Cooperative Forest Fire Prevention Campaign. The live Smokey and the poster Smokey have become one and the same.

There is no question but that Smokey is making a lasting impression on the boys and girls of this country who are the citizens of tomorrow. Smokey's fan mail from all parts of the Nation bears this out.

One mother wrote as follows: "Our hero Smokey is greatly admired by the small fry and the change of scenes on the bus cards always bring comment from my little daughter. The ads are scanned with avid interest for new pictures of Smokey and heaven help the individual who throws matches and cigarettes out of car windows. To my consternation and amusement, she tells them off. I notice that they don't do it again in her presence. These posters are doing a remarkable job in helping all of us and especially the young to become conscious of waste, destruction, and grief caused by forest fires. We hope to see Smokey for a long time to come."

Statistically the Nation-wide Cooperative Forest Fire Prevention Campaign and other fire prevention campaigns such as the Keep Green movement are bearing fruit. Prior to the start of the campaign in 1942, there was an average of 205,047 forest fires a year for the 5-year period, 1937-41. For the past 5 years, 1947-51, there has been an average of 188,796 forest fires a year on all lands. This means that we have experienced 16,251 fewer fires a year for the past 5 years as compared with a similar period of time immediately preceding the beginning of the campaign. This encouraging progress has been achieved in spite of the fact that public use of forested areas has increased 50 percent over precampaign levels.

This improvement has not been due solely to the Smokey Bear campaign conducted by the State Foresters and U.S. Forest Service. Much of the credit must go to the fire prevention programs carried on by the States themselves and also local programs sponsored by Keep Green organization, Red Cross, Boy Scouts, and others. However, through the channels for mass communication which have been made available to the campaign by The Advertising Council, the American public is hearing, seeing, and reading more about the need for preventing forest fires than ever before.

We still have a long way to go before man-caused forest fires have been reduced to an acceptable minimum. Continued progress can be made in licking this problem if government, business, forest landowners, educators, and conservationists work together in the future as they have in the past.

CLASS IN THE OUTDOORS [1]

JOSEPH F. DONOHOE
District Forest Ranger, Wisconsin Conservation Department

The protection from fires of our forests, fields, and marshes is a basic function of the conservation of our natural resources and wild life. Therefore the forest protection division of the Wisconsin Conservation Department is intensely interested in informing the citizens of Wisconsin and others why and how approximately $1,000,000 a year is spent for the prevention and suppression of fires.

Of course the best way to stop damages to our forests resulting from fires is to prevent the fires from starting. The forest ranger has learned that an informed citizen is a cooperative citizen. That is why he is willing to spend a great deal of effort and time in fire prevention work.

Where forest protection activities are intensified, as in northern and central Wisconsin, the people are pretty well informed, but there is a large segment of our population which has received less information on the subject. How to reach these citizens is something of a problem.

One method was worked out a few years ago by representatives of industrial concerns who depend on our natural resources for their supply of raw materials. It was simply to have a place where young people and adult groups could gather and receive an on-the-spot short course in conservation. This organization is the well-known Trees for Tomorrow, which operates a camp at Eagle River. There, under supervision, groups from high schools and colleges, and groups representing women's clubs, sportsmen's clubs, civic organizations and many others come. The Wisconsin Conservation Department cooperates intensively in the program offered.

The forest protection division participates by presenting a summarized but adequate over-all picture of forest protection activities in the State. This class is held in the out-of-doors, weather permitting. The feeling is that it has been very successful because of the enthusiasm with which it is received and because of the increased demand for holding such classes.

Before the program as now presented in the outdoor class room was completed, a great deal of preparatory work went into it. This work was under the direction of V. A. Moon, northern area supervisor of the forest protection division. For use by the instructor so that he can illustrate his talk, special "props" consisting of maps, charts, and equipment were designed and built.

[1] From the December 1951 Wisconsin Conservation Bulletin.

The program is presented in three parts. First a talk is given on the history, organization, finances, and administrative set-up. Secondly, the fire detection system, communications, and dispatching of men and equipment is touched upon. The third part consists of a demonstration of the equipment and methods used in the physical work of putting out fires.

The site for the class room is picked ahead of time. It usually is an isolated spot which has to be reached by a logging road. The group or students arrive by bus and in a few minutes class is in session. After a briefing on the importance of forest protection in the conservation picture the instructor reviews the history of the division and then goes into the organization and administrative set-up as it now is and may be in the future. He, glad that he has them, now uses the new "props."

The first one, sturdily built of wood, is a case of four maps, mounted on plywood panels and designed so they can be easily removed or returned as used. This "prop," as well as the others, has been built big enough for easy visibility, strong enough for rough handling, and light for easy transportation. The first panel has a map of the State on which are outlined in contrasting colored lines the territories located in the intensive and extensive protection system as well as territory that may in the future be included in our protection organization. The four areas and the 10 districts that make up the division are shown as well as the locations of division, area, and district headquarters.

The second panel has a map showing a proposed district in that part of Wisconsin not now under protection but which might be included in the future. On the next panel is a map of one of the 10 districts, District 8, which shows the district headquarters, the four ranger subdistricts, the ranger stations, and locations of the lookout towers. On the fourth and final panel a map of a ranger district shows the location of the ranger station and lookout towers and where emergency fire wardens live.

The speaker in explaining uses more props in explaining the *why*, *what*, *how*, and *where*—why fires burn worse on some days than on others; what is needed in the way of manpower and equipment to suppress fire on a given day; how fires are detected; and where they are located.

Two props, a burning index meter and a fire hazard chart, are used in explaining the factors that govern a ranger's activities in fire weather. The index meters that are used at the stations are small enough to slip into a hip pocket, but the one built for the class room is Paul Bunyan size. With it the speaker can show how wind velocity, relative humidity, number of days since rain, and condition of vegetation are used to arrive at an index of how forest fuels will burn. The fire hazard charts, identical to those used at ranger stations, show in a more readable way what the burning conditions for the day are. From this chart the ranger can also determine his manpower and equipment needs in suppressing fires that may start.

The equipment used by the men in the towers when they see a smoke is shown to the group and explained. This consists of a protractor stand, alidade or sighting instrument, and offset. The protractor, mounted on the stand, is hinged so that it can be tipped up for better visibility by the group. The group is shown use of the alidade in determining the line of sight of a fire from the tower and how the reading in degrees is taken from the protractor. The use of the offset in seeing by or around an obstruction which interferes with the line of sight is also shown.

The last prop is a magnified scale map which is used to illustrate how a ranger can plot the information received from the towers and accurately determine the location of a fire. This map is also used to explain why people in forest protection districts have to obtain a permit before burning rubbish, brush piles, etc. When a permit is issued a pin is placed in the map on the location the permit covers. This enables the ranger to differentiate between legal burning and uncontrolled fires.

Because the final part of the class is a demonstration of noisy trucks and tractors, and to better show off the use of short-wave radios, a sound amplifying system is used. This sound equipment, along with a short-wave two-way radio, is housed in a specially built cabin mounted on a two-wheel trailer. This piece of equipment was originally designed for use on large fires where it would be practical to set up a field headquarters. The trailer is equipped with a public address system, the radio, a desk, storage space, and its own power plant.

In putting on the last part of the program emphasis is placed on how, when, why, and where trucks, tractors, water tank trailers, and radios are used. The control trailer or sound truck is used to a good advantage. By using the sound amplifying system the speaker, in describing what is going on, can reach the group which becomes scattered during this period.

A brush pile, one of several which were previously prepared, is ignited, and when the fire is burning briskly, the speaker uses the radio in the control car to summon the first piece of equipment to be demonstrated. His message to the equipment operator is picked up by the sound system and the group can hear what he says and the operator's reply. All of the equipment to be demonstrated is located out of sight and a short distance away from the group.

As the first piece of equipment, a ¾-ton truck equipped with a power take-off pump, a water tank, and a compliment of hand tools and towing a water tank trailer, goes into action, the speaker keeps up a running commentary on what is going on. After the fire is pumped out with water, a crew of men, which arrived with the truck, puts on a demonstration of the use of hand tools in suppressing a fire. A short stretch of control line is constructed by four men working as a team, who use three short-handled shovels and a swede hoe. Then the use of a back-pack water can with an attached hand-operated pump is demonstrated. A man

then shows how the old reliable shovel can be used to throw dirt on fire edges, cover burning stumps with dirt, and bury burning logs and chunks of wood.

To demonstrate the use of the new mobile pack-set radio, the remaining equipment units are called in by an operator who is stationed in front of the group. These messages can also be heard over the loud-speaking equipment. Another brush pile is set on fire, the man with the pack-set radio puts in his call, and a few minutes later a 2-ton truck arrives. This is equipped with a power take-off pump, water, and a large complement of hand tools, and tows a tilting-bed trailer on which is transported a tractor and water tank trailer. As these items of equipment go to work putting out the fire the commentator tells the group what is being done and why.

When this unit of equipment is finished, another is summoned by field radio. This one excites the most interest, especially among male members of a group. The unit consists of a 2-ton truck equipped with a power take-off pump, water tank, and complement of hand tools, and towing a tilting-bed trailer on which is transported a crawler type tractor with a large specially designed fire plow attached. When the tractor and plow is unloaded and starts to plow a 6-foot-wide double furrow the group really sits up and takes notice, and when the tractor and plow starts off through the woods, knocking down trees and leaving a wide fire break behind, the members of the group like to follow right behind it.

As the tractor and plow is loaded and the truck moves off, another fire is started and the final unit of equipment is summoned. This is a large truck which transports a 1,000-gallon water tank. The truck is also equipped with a power take-off pump. The unit proceeds to put the fire out; two hose lines are used and different types of nozzles demonstrated, one an adjustable spray nozzle and the other a conventional type. After the demonstration the group is invited to inspect the equipment and ask questions.

This ends the class; the maps, charts, and other paraphernalia are quickly stored in the sound car, the trailer is hooked to a truck, and the school room is ready for the road. It has been a pleasant, informal, and worth-while session in a room as large as the outdoors. At the same time, fire fighting equipment has been tested and men trained, something which would have to be done periodically even if there were no students to watch the proceedings.

Published Material of Interest to Fire Control Men

A Survey of Forest Fire Causes and Suggested Corrective Measures, by J. A. Doyle. Forestry Chronicle. Dec. 1951.

Forest Fire Insurance in North America, With Special Reference to B. C., by W. Walters. Brit. Columbia Lumberman. Dec. 1951.

Incidents in Tower Man's Typical Day, by C. Lucas. W. Va. Conserv. Jan. 1952.

South Carolina Stresses the Importance of Protecting Little Trees in the New Fire Prevention Program, by J. C. Witherspoon. Forest Farmer. Jan. 1952.

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POWER-SAW MOTOR DRIVES PORTABLE FIRE PUMP

IRVIN H. LUITEN
Field Representative, Public Information Department, Weyerhaeuser Timber Company

In a matter of 90 seconds, Weyerhaeuser Timber Company foresters at Springfield, Oreg., can turn an ordinary power saw into a portable pump for fighting forest fires. They do it by attaching a standard low-speed, high-pressure pump to a power-saw motor.

The attachment is made possible by a coupling and mounting invented by Robert Gehrman, the company's Springfield branch forester.

With a special frame and guide developed by Gehrman, the standard fire pump is mounted to a packboard. The frame and guide are designed so that the pump may be fastened to the saw motor at the point ordinarily occupied by the saw bar. The same nut that secures the saw bar hooks the pump to the saw engine (fig. 1). No extra parts or special tools are needed.

FIGURE 1.—Pump is hooked to power-saw motor with same nut that secures the saw bar. Three-pronged rubber-faced coupling (at center right, below hand valve on pump) meshes with saw chain sprocket.

FIGURE 2.—Cecil Cunningham, Weyerhaeuser Timber Company forester, Springfield, Oreg., demonstrates power-saw fire-pump combination. In fighting actual forest fire, two hoses, each fitted with nozzle, would be used.

Used on Weyerhaeuser's logging operations near Springfield since early 1951, the power-saw and fire-pump combination has proved itself an effective fire fighting tool. Drawing water from streams, ponds, and lakes in the woods or from water tank trailers, a 7-horsepower motor with pump attached will spray a fire through two hoses and two 5/16-inch nozzles. It will develop 100 pounds pressure. A pump attached to a 5-horsepower motor will drive water through two hoses and two nozzles at 75 pounds pressure.

Weyerhaeuser foresters are using the combination as a two-man unit. The pump—along with suction hose and screen, siamese valve, two nozzles, a small grease gun, and a hose spanner—is fastened to a packboard (fig. 2). This makes a one-man load weighing 57 pounds. The other part of the two-man unit is a power bucking saw minus the bar and chain (fig. 3).

Says Gehrman: "There are many advantages to this unit. The pump can be attached to the power-saw engine in about a minute and a half. Your pump operator is the power-saw operator. He knows how to start the engine and keep it running because he operates it every day. There is no cooling system to drain or any separate gas tank to bother with. And the pump itself is less costly than conventional forest fire pumps that will handle two hose lines.

"We have operated these units wide open for steady runs of 2 hours and longer, and the power-saw engine and pump functioned

FIGURE 3.—Power-saw fire-pump combination is a two-man load. Robert Gehrman, who invented the coupling by which pump is attached to power-saw motor, demonstrates: **Left,** carrying pump on a packboard; **right,** packing power-saw motor.

perfectly. You could touch the cylinder cooling vanes on the engine at any time without burning your fingers."

Weyerhaeuser foresters have used the pump on 5-horsepower and 7-horsepower saws.

"But," Gehrman points out, "I am quite certain that the same principle of driving a pump through a rubber-faced coupling fitted to the chain sprocket would be adaptable to any power saw."

The power-saw fire-pump combination is now in service on several Weyerhaeuser woods operations and is also being used by several other lumber companies in the Springfield area.

Couplings and mountings invented by Gehrman are manufactured under license by two firms, one in Portland, and another in Eugene, Oreg. (Further information regarding this equipment may be obtained from Dept. of Public Information, Weyerhaeuser Timber Co., 1106 U.S. National Bank Bldg., Portland 4, Oreg.)

REMOTE-CONTROLLED RADIO NETWORK AND FIRE COMMUNICATION EQUIPMENT

R. C. FRANKLIN, *Fire Prevention Officer*, and A. D. GALBRAITH, *Communications Technician, Angeles National Forest*

When FM radio replaced AM on the Angeles National Forest it was decided, after extensive tests, to use remote-controlled sets so that a single channel could provide forest-wide communication.

Figure 1, showing locations and elevations of our fixed stations, illustrates the problem with which we were confronted in effecting complete radio coverage. The entire forest is not shown. Additional area to the north is mostly at lower elevations, with more gentle slopes, where no particular problems were encountered.

The central dispatcher and Arroyo Seco and Glendora Ranger Station offices are at elevations of 520, 1,100, and 776 feet, located at the base of the south slopes of a range of mountains. These three stations have direct communication between one another. The Valyermo headquarters, 25 miles airline to the northeast from Arcadia, is on the desert side of the range with intervening peaks reaching over 9,000 feet; Newhall Ranger Station, 32 miles northwest, is also blocked off by mountains.

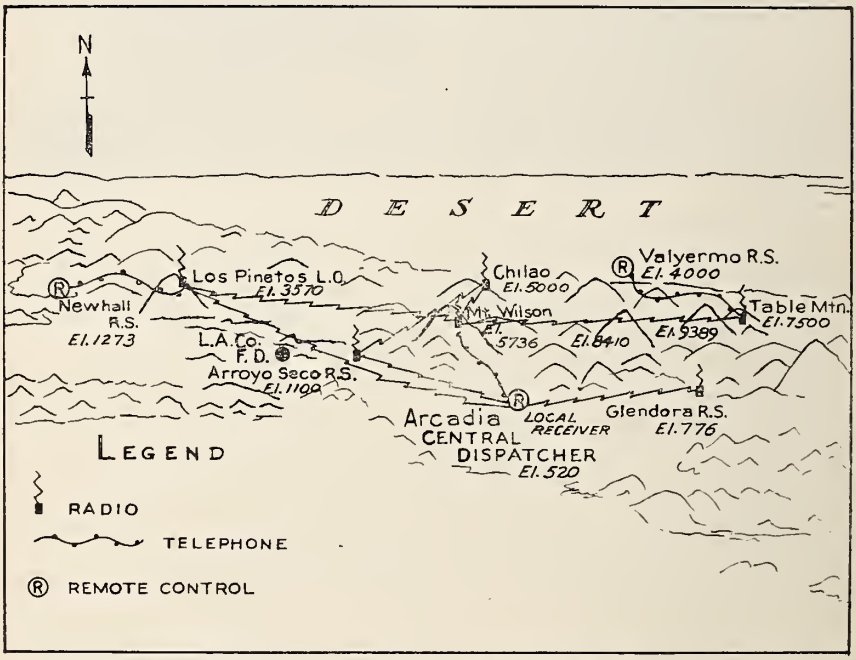

FIGURE 1.—Diagrammatic sketch of Angeles Forest radio network.

An unattended transmitter and receiver are located atop Mt. Wilson overlooking Arcadia headquarters and remote-controlled to the dispatcher's office over leased lines of the Pacific Telephone & Telegraph Company. Similar installations were made from Valyermo to Table Mountain and Newhall to Los Pinetos, with Forest Service telephone lines providing remote control. These latter two units are at sufficient elevations so that they work directly to Mt. Wilson. A local receiver is installed at Arcadia for use along the base of the mountains, in areas blind to Mt. Wilson, and serves the dispatcher and two front country ranger districts. The Los Pinetos remote-controlled unit works direct to this receiver as well as to Mt. Wilson. With these installations there are very few blind spots on the entire forest.

As a safeguard against commercial power failure, gasoline-driven generators are installed at the remote control sites. In the event of power interruption these generators start automatically and shut off when regular power service resumes. Automatic time clocks are used to start the generators once a week to keep them in working order.

All special equipment illustrated and described in this article was designed and built by A. Donald Galbraith, Angeles National Forest Communications Technician. Everything has been designed for compactness and simplicity of operation, yet there is equipment to cope with most any communication need.

For use in fire camp a remote-control console is installed in a ½-ton panel truck (fig. 2). The cabinet measures 11 by 20 by

FIGURE 2.—Communication truck with remote-control console.

41 inches. One side is hinged to provide a working desk for two operators. This unit provides control of a single frequency transmitter and receiver which can be any standard mobile installation, or a portable one. The transmitter-receiver can be located several miles distant and connected to the remote-control console by a single pair of wires, either telephone line or emergency wire.

The cabinet is held in place by four wing nuts and may be quickly removed and set up in fire camp on a table when it becomes necessary to use the radio truck elsewhere. Lower left controls are for FM transmitter and receiver; immediately above is a general-coverage radio operating on 550-4500 kc. The microphone on top of the console operates a loud-speaker system. To the right above is storage space for stationery and records. Below this is a telephone switchboard with six trunks. From this control console one operator can handle fire camp radio and telephone traffic most of the time. Occasionally, at peak periods, it is necessary to have two men on duty.

When it is necessary to set up fire camp at low elevation in a location blind to all of the other fixed stations a portable remote (fig. 3) is used. This is a 30-watt, 6-volt DC unit, with gasoline engine charging equipment. It can be located up to 30 miles from fire camp and remote-controlled from the fire camp console via telephone line or emergency wire.

Communication headquarters are usually set up away from the noise of fire camp, and army type field phones are used at the headquarters of the fire boss, transportation officer, timekeeper,

FIGURE 3.—Portable remote unit.

camp boss, etc. Intercommunication between all points in fire camp is then provided by these telephone trunks. Whenever possible a connection with commercial telephone service is made to keep air lanes clear for traffic from the fire line.

Instead of operating radio equipment by power directly from the fire camp AC generator, 6-volt DC power is used. This prevents communication failure should the generator stop. Battery level is maintained either by a separate gas engine charger or an AC charger operated from the fire camp generator.

For further flexibility in fire camp communications a compact, low-drain, dry-battery-operated console (fig. 4) is used as an extension of the main radio, or independently, to perform the same technical functions. This set is used principally by the fire boss and Service and Plans Section at GHQ. It is immediately usable without warm up when turned on.

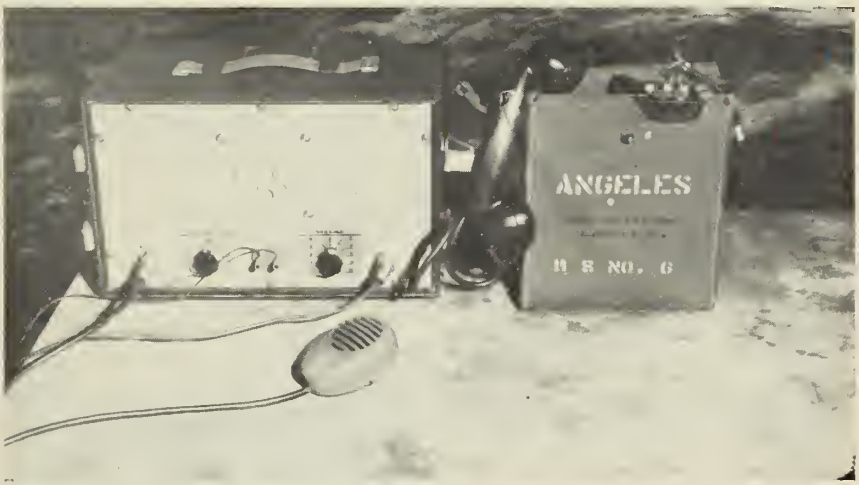

FIGURE 4.—Fire boss console.

Central dispatching is used on this forest and a compact dispatcher console (fig. 5) was designed with controls conveniently located. In addition to the Mt. Wilson set, controls are provided for a local receiver, one frequency of the Los Angeles County Fire Department, an all-wave general-coverage receiver, and eight intercommunication stations connecting the forest warehouses, radio shop, equipment service, equipment development center, and fire crew barracks, all located at Arcadia headquarters.

One battalion headquarters of the Los Angeles County Fire Department, located in the high-value front country area, has a receiver on the Angeles frequency. This enables the two agencies to have communication through cross-band transmissions during joint action fires and for compiling daily weather observations used in determining fire danger indexes.

Radio is used extensively on this forest in fire control work, air and ground rescue operations, flood observations during heavy

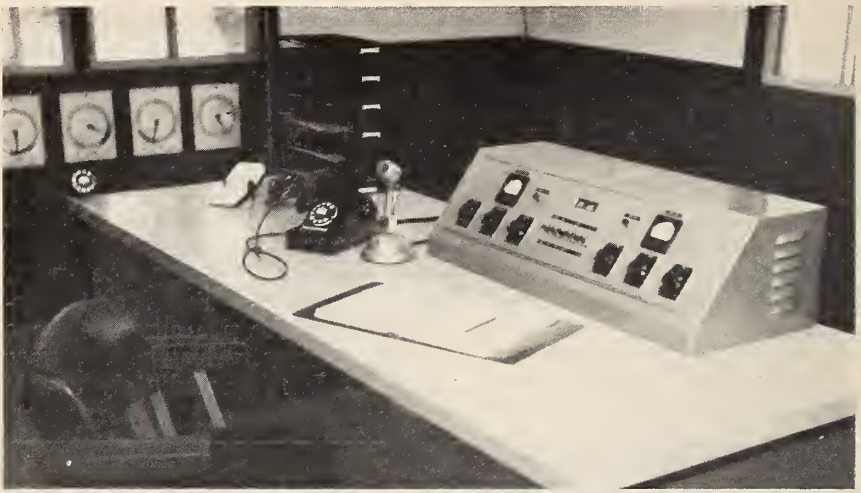

FIGURE 5.—Dispatcher console.

storms, and other emergencies. At present the network consists of 6 fixed stations with 46 mobile units and 30 handie-talkies. The system has been in operation for a sufficient length of time to test it thoroughly under heavy use during major fires and other emergencies and has proved its efficiency with a minimum of service requirements.

Flash Fuel Fire Beater

Specialized hand tools are needed for the manual suppression of cheatgrass and other light flash fuel fires under some conditions. This is particularly the case on rocky sites where a lack of loose soil makes the use of shovels ineffective. Oversized beaters of the fly-swatter type have not been effective because they scatter the fire when an up-and-down beating motion is used.

FIGURE 1.

In an attempt to overcome this effect, a cat-o'-nine-tails type of beater has been devised (fig. 1). When used with a sideways action, this beater knocks out the fire in grass. With a sideways force, burning embers are knocked inside of the fire line.

This tool is made from a rake handle cut to a length of from 44 to 48 inches. Twenty-four-inch sections of rubber inner tube, truck tube weight, are used for the tails. These sections are cut in strips $\frac{5}{8}$ to $\frac{3}{4}$ of an inch wide to a length of 21 inches. There should be from 24 to 30 tails. The 3-inch uncut band of rubber at the top of the tails is wrapped around the end of the shovel handle and secured by 3 nails in vertical alignment, reinforced by a dozen wrappings of wire.—PIERRE SARASOLA, *Foreman, Toiyabe National Forest.*

WIND AND DRIFT INDICATOR

W. C. Wood
Foreman, Smokejumper Project, Region 1, U.S. Forest Service

Helicopter pilots in Region 1 use natural heliports that are usually located in remote or back country areas where there are rarely wind socks or wind indicators of any kind. Knowledge of wind currents, their direction and intensity, enables a pilot to land in small spots with less difficulty.

The Aerial Equipment Development Center at Missoula was asked to help find some device that could be carried in the helicopter and thrown out over a proposed landing spot to serve as a wind sock after its contact with the ground. Drift chutes are not satisfactory because of their weight and bulk, and also because they give little or no indication of ground drift after they land.

A streamer-type wind indicator was developed that gives accurate wind direction and indicates, by its degree of movement, wind intensity. This streamer consists of a piece of lightweight orange crepe paper (4 by 84 inches) that is Scotch-taped to a piece of black crepe paper (4 by 18 inches). An 18-inch piece of light thread with a single split shot (oo buck) clinched to its lower end is Scotch-taped to the bottom of the black paper. The streamer is rolled up, thread and shot last, and as many as 12 can be stored under the 'copter's seat cushion without adding appreciable weight or causing discomfort to the pilot.

The pilot, upon approaching the proposed landing site, has only to reach under the seat and with one hand uncoil a few turns of the weighted thread. Immediately above the spot he tosses the streamer out and continues his flight pattern to where he is able to watch the streamer. The weighted string unwraps the streamer automatically during the first stages of the descent. After the shot reaches the ground, the wind blows the lightweight paper away from the anchored shot. The black section serves to identify the weighted end. If wind is absent or negligible the streamer will fall in a heap. If gusts come up the streamer will lay out according to wind intensity.

In the earlier stages of development it was thought that the string could be eliminated. A few models with the shot clinched directly to the black crepe paper were tried. They were satisfactory in all respects except two: On snow courses, high winds would drag the streamer along the snow, and the split shot was more easily torn from the paper, both in handling and after discharge from the 'copter. It is thought that the length of string will allow the streamer more freedom in low brush and grass.

The streamers have been tested on actual helicopter missions on several occasions and pilots report 100-percent success in all tests so far. One pilot enthusiastically reported that even during descent the streamer gave him drift indications according to the attitude in the upper tip of the streamer. The Region 1 contract helicopter is equipped with a dozen streamers for further testing and application.

MAINE FORESTERS PUT FIRE PROTECTION ON STAGE

ARTHUR G. RANDALL
Assistant Professor of Forestry, University of Maine

Forest fire protection was dramatized effectively for some 3,000 people attending the 14th Eastern Maine Sportsmen's Show at the Bangor Auditorium, April 21-26. The theme of the show, sponsored by the Penobscot County Conservation Association, was Keep Maine Green. The Maine Forest Service exhibited a fire danger station, forest products, and forest tree leaves and fruits.

A group of forestry students from the University of Maine, known as the "Hot-Shot Fire Crew" appeared each evening and Saturday afternoon as one of six acts on the stage. Over 60 students took part altogether, with 28 appearing in each show. They wore red hats, levis, heavy shoes or boots, and shirts or jackets bearing a distinctive "Maine forester" shoulder patch.

The stage was permanently decorated with a background of evergreen saplings. It was set for the Hot-Shot performance by laying planks, extending for 60 feet parallel to the audience. Saplings were inserted in holes drilled 2 feet apart and the planks covered with pine needles. Since the stage lacked regular footlights, they were improvised by placing red lights in a notched board. Four wash basins were filled with warm water. A canvas relay tank was set up and a few inches of water poured in from buckets. A student narrator explained the action over the loudspeaker.

A hunter armed with a shotgun sneaked through the artificial forest, fired two blanks, and was rewarded with a small roll of canvas tossed out by the property man. Excited by his good fortune, he carelessly leaned the shotgun muzzle against his belly, while he stoked his pipe. He ostentatiously tossed his match away to the pious ejaculations of the narrator and stalked off stage. The property man plugged in the red lights and dropped dry ice in the basins of warm water.

Smoke was a problem, as the dry ice vapor would not rise but hugged the floor. The solution was a bee smoker, which emitted dense clouds of white smoke. Burning pine needles in it gave a genuine forest fire flavor.

A siren sounded the signal that the fire had been discovered and the suppression crew was on the way. The crew tooled up from a red box on the stage. The organization was a one-lick system under a foreman. A line-clearing squad of strawboss with double-bit ax and three men using pulaski tools felled the trees standing in the planks. A line-building squad of strawboss and five men used adz-hoes and mower-teeth rakes. A line-holding squad of strawboss and five men using paired backpack pumps and lady's shovels maintained continuous patrol. These men wore headset flashlights donned before going on stage.

Although, as the narrator pointed out, the size of the stage did not permit use of bulldozer or tank truck, a 1½-inch hose was brought in and water pumped into the canvas tank from a pumper operating just outside the rear door. A second canvas tank was the source of water. If a second hose line was attached to the siamese and both open, the pressure on stage was not great enough to splash the audience.

Overhead lights were turned out and headsets on to show night patrol and the red lights extinguished one by one as mopping up proceeded. As the lights came on again to tumultuous applause, the rest of the crew came back on, prodding the firebug ahead of them.

The Sportsmen's Show was just one project of the Hot-Shot Crew, which stands ready to go to real fires and has two other demonstrations scheduled this spring.

Stainless Steel Water Tanks

The Illinois Division of Forestry has six 1-ton trucks equipped with 16-gage stainless steel water tanks. These tanks, each with a capacity of approximately 110 gallons, have been in service for almost a year and have proved to be very satisfactory. Water taken from them is clear and free from any corrosion particles. It is believed that pump repairs will be reduced because of the clearness of the water.

The tanks were constructed by a local welder at a cost of $142.85 per tank. Each one is 78 by 18 by 18 inches with two baffle plates running crosswise of the tank. A 2-inch filler plug is placed 2½ feet from one end of the tank on top. A 1-inch outlet is placed in the bottom, 6 inches from the end of the tank.—RICHARD THOM, *Staff Forester, Illinois Division of Forestry.*

Rubber Tanks to Help Keep Oregon Green

As an additional weapon against forest fires, an Oregon lumber firm this year is installing about a dozen huge ex-Army rubber tanks at its woods operations.

Each landing is to have one of the 3,000-gallon tanks to give it an extra and sure water supply at all times.

The Williamette Valley Lumber Company and affiliated firms, one of which is the Williamette National Lumber Company, are installing the collapsible tanks to augment a fleet of tanker trucks, bulldozers, portable pumps, and various other equipment items and tools held in readiness in the event of fire.

The tanks are made of heavy neoprene rubber and were manufactured for use in Army filtration plants overseas. They can be set up anywhere and are readily filled, emptied, and moved. The substantial capacity is counted on to give each logging operation a water supply large enough to provide "that extra safety factor."—ALBERT H. WEISENDANGER, *Secretary, Keep Oregon Green, Association.*

SLIP-ON PUMPER UNITS FOR FOREST FIRE SUPPRESSION IN THE DOUGLAS-FIR REGION

L. T. WEBSTER, *Deputy State Forester,* and DON LEE FRASER, *Assistant State Forester, Division of Forestry, Washington*

In considering the optimum type of mobile pumper to put in operation for forest fire suppression, at least two factors should be considered. These are what fuel types are involved in the areas covered, and what is the length of season during which the mobile pumper will be used each year?

If the equipment is to be used in heavy fuel type, such as areas with sizable concentrations of unburned slashing, it is desirable to have tanks and pumpers of larger capacities than would normally be required in areas of average fuel, where volume can be sacrificed in favor of speed and mobility.

In areas where the fire season extends throughout most of the year, it may be advisable to build the tank and pumper equipment as an integral part of the unit. In areas where the fire season runs 6 months or less and where the truck may be effectively used for other purposes during the off season, it is advisable to use a slip-on type unit complete with power pumper.

The fire season in the State of Washington normally occurs within a period of 6 months or less each year. Except for a few large-volume units, the most efficient mobile pumpers have been determined to consist of slip-on units placed on conventional trucks of varying capacities. On this basis, the Washington State Division of Forestry during 1951 and 1952 has developed, with a view toward standardization, four types of slip-on units as follows:

155-Gallon rectangular slip-on unit to be used on 1-ton Willys, four-wheel-drive pickup.—Tank dimensions and fixtures: Width 47 inches, length 49 inches, height 16 inches, with bolt-on cover, baffled into four compartments, with two bolt-down brackets on each end, two sling loops on each side of top, 4-inch filler cap, and 1½-inch drain plug (fig. 1).

240-Gallon rectangular slip-on unit to be used on Dodge power wagon.—Tank dimensions and fixtures: Width 48 inches, length 49 inches, height 24 inches, with bolt-on cover, two bolt-down brackets on each end, two sling loops on each side of top, 4-inch filler cap, and 1½-inch drain plug (fig. 2).

210-Gallon rectangular slip-on unit to be used with ¾-ton Ford or 1-ton Chevrolet standard pickup truck.—Tank dimensions and fixtures: Width 48 inches, length 84 inches, height 12 inches, with welded cover, baffled into six compartments, with two bolt-on brackets on each end, two sling loops on each side of top, 6-inch vented, watertight filler cap, and 1½-inch drain plug (fig. 3).

Each of these three units has a WA-7 pump, manufactured by a Seattle company, mounted in a cradle on top of the tank with

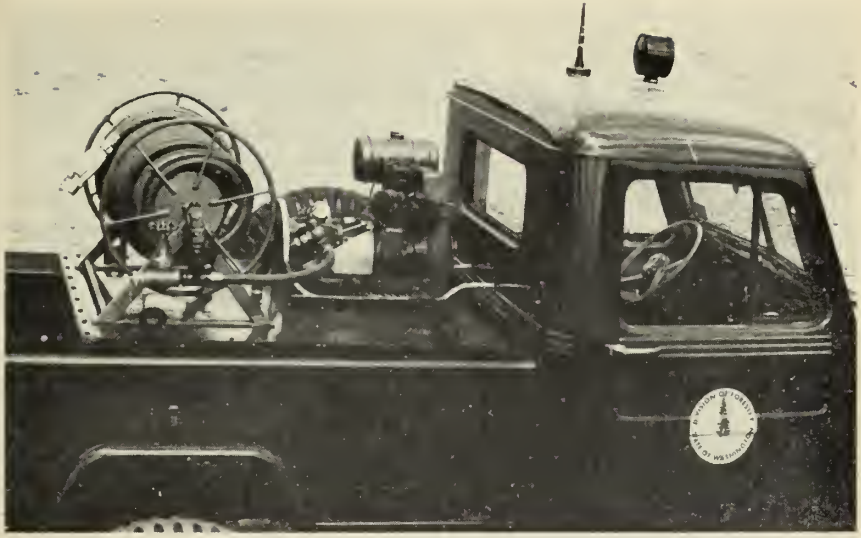

FIGURE 1.—155-gallon slip-on unit.

quick-detachment fittings. A live hose reel carrying a minimum of 200 feet of ¾-inch, semihard rubber hose is mounted on top of the tank adjacent to the pumper. Hose is equipped with a suitable 1-inch combination shut-off nozzle readily adjustable to fog or straight stream. Size of stream may be varied by changing nozzle tip.

These units are designed to operate at pump pressures up to 250 pounds per square inch and volumes up to 25 gallons per minute depending on nozzle orifice and other variable factors.

500-Gallon rectangular slip-on unit to be used on conventional Ford, Chevrolet, or Dodge 1½-ton stake-side, dump, or flat-bed trucks.—Tank dimensions and fixtures: Width 70 inches, length 90 inches, height 18 inches, with cover welded on, baffled into six

FIGURE 2.—240-gallon slip-on unit.

compartments, with two bolt-down brackets on each end, two sling loops on each side of top, 6-inch vented, watertight filler cap, and 1½-inch drain plug (fig. 4). A WX-10 pumper, manufactured by a Seattle company, is mounted in a cradle on top of tank with quick-detachment fittings. A live hose reel carrying a minimum of 300 feet of ¾-inch, semihard rubber hose is mounted on top of the tank adjacent to the pumper. Hose is equipped with a suitable 1-inch combination nozzle readily adjustable to fog or straight stream. Size of stream may be varied by changing nozzle tip. A 1½-inch tee with valve is placed between pumper and hose reel to permit laying a 1-inch or 1½-inch hose line direct from truck. This unit is designed to operate at pressures up to 250 pounds per square inch and volumes up to 40 gallons per minute depending on nozzle orifice and other variable factors.

All tank shells are preferably constructed from 12-gage Mayari steel with baffles of 14-gage Mayari steel. Baffles are all plug-welded.

A 1½-inch suction strainer with cylinder 8 inches in diameter by 8 inches in length, and capped on each end, is used in all units. The shell on the strainer cylinder is constructed from 1/16-inch tinned steel perforated with ⅜-inch holes on ⅝-inch centers, and wrapped with 40-mesh Monel wire cloth. A 1½-inch galvanized pipe passing through and welded to the center of one end cap extends to within 1 inch of the other end cap. This strainer is used in a vertical position in either forward corner of the tank. The suction strainer extends through a manhole with bolt-on cover to permit free passage of the strainer to and from the tank for inspection or repair. This suction strainer is especially important when rotary gear pumps are used. Suction line from tank to pumper is flexible, hard hose with slotted screw-type couplings. Discharge line from pressure relief valve to live hose reel is flexible semihard rubber hose. On all of the units under 500 gallons, a 1-inch tee with valve is installed between pumper and live hose reel to permit laying 1-inch hose line direct from pumper when desired.

A properly designed bypass valve adjustable within the pressure limits to be used is installed on the discharge side and adjacent to the pumper. Bypass water is carried through separate ¾-inch garden hose into the tank. The bypass or pressure relief valve is very important as it functions automatically as the shut-off nozzle is opened or closed. This eliminates excessive strains on equipment and saves materially in hose breakage and replacement.

All units have plywood tool boxes designed to carry hand tools for five to ten men, depending on local requirements. In addition to this, tool boxes carry gasoline and oil, pumper tools, and 500 feet of 1-inch cotton rubber-lined hose.

A properly designed slip-on unit has the following advantages:

(1) If the portable pumper is properly mounted it may be quickly detached and moved to a source of water supply for filling the tanker, far beyond the normal suction lift of a pumper which

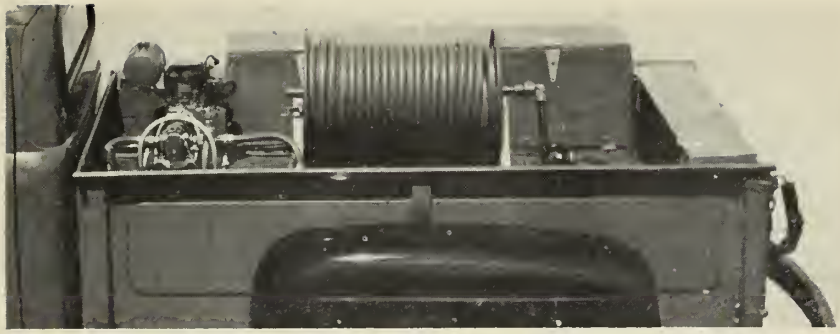

FIGURE 3.—210-gallon slip-on unit.

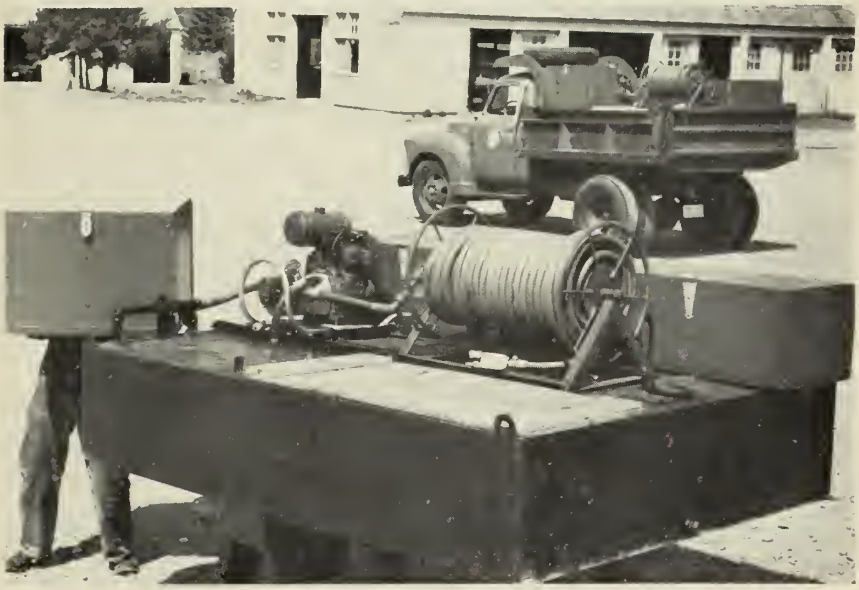

FIGURE 4.—500-gallon slip-on unit.

cannot be detached from the truck. It may also be removed from the truck and used as a separate pumper unit to pump direct from water supply onto fire in many locations where a truck could not get to the water supply.

(2) A slip-on unit does not tie up an expensive truck so that it cannot be used for any purpose other than a tank truck. It is a simple matter to load or unload as needed.

(3) It is a simple matter to transfer a slip-on unit from one vehicle to another in case of truck failure or when a new truck replaces the old one.

(4) A slip-on unit incorporates all of the pumping equipment and tools to make it a self-sufficient fire fighting unit. It is ready to go instantly without the delay involved in assembling various items which may be needed.

TANKER SPRINKLER BAR

ARCADIA EQUIPMENT DEVELOPMENT CENTER
California Region, U.S. Forest Service

In order to alleviate dusty conditions at forest stations, recreation areas, campgrounds, and fire camps, fire trucks are frequently used for sprinkling purposes. Naturally, it is a slow and inefficient process to settle the dust by means of hand sprinkling with a hose. This explains the request by the California Region for a portable sprinkling system which could readily be attached to a tanker.

Such a sprinkling system, which attaches onto either the front or rear bumper of a truck, has been built at the Arcadia Equipment Development Center.

It consists of two pieces of 1¼-inch pipe, each 3 feet long, coupled in the middle by a swivel joint (fig. 1). This allows disjointing for carrying in one of the tool boxes. Any size pipe from 1-inch up would serve the purpose. Four holes, equally spaced on the pipe, serve as orifices for expelling water which is sprayed out in fan-shaped patterns by deflectors.

The width of the four sprays, where they hit the ground, can be regulated by rotating the pipe so that a uniform sprinkling job results. As shown in figure 2, the over-all width of the sprinkled strip is 8 feet. Should a wider strip be desired, additional sections of pipe could be added, or longer pipes used which would still fit in the tool box.

FIGURE 1.—Sprinkler bar and clamps.

FIGURE 2.—Sprinkling at a nozzle pressure of 125 pounds per square inch.

Two adjustable clamps hold the pipe in place and attach firmly onto any bumper. The clamps on the pilot model are well machined and, therefore, cost more than is absolutely necessary. However, the design proved very effective for holding the unit in place. The J-bolts are made sufficiently long to fit a bumper 8 inches wide. For narrow bumpers, washers cut from ¾-inch pipe are used to take up the slack. If preferred, a simple arrangement of "C" clamps could be used as a substitute for the design shown.

The four holes are drilled 5/32-inch in diameter, which allows a combined flow of approximately 18 gallons per minute when pumping at a pressure of 100 pounds per square inch. The deflectors used are a commercial item which can be purchased for approximately $1.50 each.

A 1-inch swivel inlet provides ready attachment of the 1-inch hose line from the live hose reel. The pilot model is equipped with a quick-throw valve which can be rigged with pulleys and rope for control from the cab. This, however, is optional and may be omitted for the sake of economy. The hose reel shut-off valve could be used as a substitute control.

Drawings or information regarding this item can be obtained from the Arcadia Equipment Development Center, 701 N. Santa Anita Ave., P. O. Box 586, Arcadia, Calif.

PARA-CARGO NETS

W. C. Wood
Foreman, Smokejumper Project, Region 1, U.S. Forest Service

Until recent years, para-cargo in Region 1 was man-tied and roped for dropping, much in the same manner as for mule transport. Small bundles required extra time and labor when they were to be dropped in one unit.

A canvas cargo sling was developed for handling these small packages as one load. This sling consisted of a 6-foot-diameter piece of 22-ounce canvas with C-10 webbing straps sewn at right angles to each other across the canvas and with buckles attached to straps. The perimeter of the canvas was hemmed and fitted with grommets through which a drawstring of ¼-inch rope was laced. Loading of this net is simple and fast. The canvas may be spread out on the floor and several small bundles placed in the center according to fragility or size. The canvas is drawn up to cover the sides and secured tightly with the drawstring. The webbing straps and buckles are fastened to form a loop for attaching the parachute.

The canvas sling is entirely satisfactory in all respects except cost. The sling requires 4 yards of canvas at a cost of $4.22. Salvaged or condemned parachute webbing was formerly used on the straps but is no longer available. Seven yards of C-8 webbing are required at a cost of $1.40. Hardware costs $1.25 and labor approximately $5.00. The total cost is $11.87. These slings are frequently not returned from the fires and a cheaper sling is desirable.

Two types of fish netting were used as substitutes for canvas in two experimental models (fig. 1) to reduce cost in materials. The netting is 1-inch square mesh. The white netting is new nontreated fish netting which costs 90¢ a yard. The dark green netting used is condemned fish netting which costs about 7¢ a yard.

It was hoped that the green used netting could serve as a substitute for canvas, but strength tests show it to be too far deteriorated to withstand most parachute openings. Box corners or projections can shear the cord even in loading and handling.

The white netting is much stronger and makes a more satisfactory para-net.

Two nets were constructed from the pattern of the canvas para-cargo sling. An unusual number of fabricating problems were encountered in constructing these models. Netting does not "lay-out" like canvas and other solid fabrics; hence there is difficulty in cutting to measurements. Netting does not lend itself to easy and fast sewing machine work. The cords and knots of the net become entangled in the foot and feed mechanism of the sewing machine. It was found that the netting had to be "sandwiched" between two strips of webbing to insure smoother feeding action through the machine, so an additional webbing piece was required. The small hard knots of the netting deflected and broke machine needles. Folds and hems were difficult to hold in alignment during

FIGURE 1.—Experimental cargo nets: new, white fish netting; inexpensive, used fish netting (dark green); white netting containing cargo and with chute attached.

sewing and resulted in sloppy work. Labor cost of the net sling was $20 on each of these models or about three times that of a canvas net.

Three test drops at an airspeed of 90 miles per hour were made on the net models with the following results:

Drop	*Description*	*Weight (pounds)*	*Results*
1	White netting with SPF radio box and sandbag.	65	Radio box shifted sideways inside net, but overall performance satisfactory.
2	Green netting with SPF radio box and sandbags.	65	Twelve-inch tear developed at corner of box. Webbing saved box from going out of net. (Damage on the first drop eliminated this sling from a second test.)
3	White net with small boxes, canned goods dumped in at random.	150	Entirely satisfactory, no tears or holes.

From the two drops with the white net sling it appears that the white net is strong enough to serve as a substitute for canvas; however, cost of construction on this model would rule it out.

A simpler design has been devised which reduces labor on a new model to about $1. The new model consists of an 8-foot square of netting with its sides turned 2 inches and rolled inward to four complete turns. A 30-foot piece of parachute suspension line is threaded through the folded mesh of the rolled hem at 6-inch intervals in the same manner as though the hem contained grommets or eyelets (fig. 2). Cargo packages may be confined by placing

FIGURE 2.—Experimental cargo net which, because of low cost, may be considered disposable.

them in the center of the net and drawing the parachute line up from the corners and sides until the hem is constricted to approximately 6 inches. The cargo chute is attached to multiple loops formed by the parachute line drawstring. Operational tests on this model are forthcoming. These nets have considerable promise for confining light packages and because of the low cost may be considered disposable where return transportation is expensive. We believe, however, that permanent net-slings should have some webbing reinforcement for added strength when 150- to 200-pound loads are contemplated.

One objectionable feature of netting is its tendency to snag and hang up on the slightest projection. Even small screw heads not properly countersunk into the floor of the aircraft will catch on the net. Extra precaution should be taken when dropping netted packages. A flat piece of cardboard may be attached to the bottom of net cargo slings to alleviate this hindrance, but this adds another step to impede the predischarge maneuvering.

MAINSTAYS OF FOREST FIRE PROTECTION [1]

A. A. Brown
Chief, Division of Forest Fire Research, U. S. Forest Service

Fire is an old friend, and an old enemy of man, depending on how well it is used and controlled. As a friend, it serves everyone, but as an enemy it threatens us all, too. But the responsibility for keeping it under control falls generally to a small group. The acceptance of such a responsibility is a common characteristic of all fire men and is something that all of us here have in common. A good part of the task ahead is to get more people to accept that responsibility toward fire.

I happen to represent men who take on that responsibility in woods and wild lands—the forest fire fighters. They have a common purpose with all other fire fighters but they work in a very different environment so the job differs, too, in many respects. The forest fire fighter is a long way from city hydrants and he is lucky if he can get to his fire on wheels.

We in the forest fire fighting services have been busy mechanizing wherever we can in the last 10 years, and we have much to show in the way of equipment development. In 1950 a total of 1,500 miles of fire control line was worked by the aid of machines of various kinds on or in the defense of the national forests alone. Even so, 83 percent of the forest fires attacked by the national-forest organization are still controlled by men on foot using hand tools and woodsman's methods.

In the U.S.A. forest fire fighting is a big job every year and a costly one. On the national forests there are usually over 10,000 fires controlled each year and on areas protected by State and private agencies there are about 80,000 additional fires. The total number of forest, brush, and grass fires reported each year amounts to close to 200,000.

Much of the threat from forest, brush, and grass fires is to improved property of all kinds. Consequently, what happens in forest fire fighting has a considerable impact on the success of the protection of improved property. In every bad forest fire year, there is a noticeable jump in losses to insured property. There are several reasons that should interest all fire chiefs.

In the United States only about 7 percent of our land area is included within city limits or other units in which organized fire departments operate. The other 93 percent of the land area is in rural country and wild lands. This, too, creates an important distinction in the fire fighting job. Forest fire protection is widely scattered while municipal and industrial protection can be highly concentrated.

[1] Paper presented at the May 3-5, 1951, sessions of the Dominion Fire Prevention Association, Windsor, Canada.

Organized forest fire fighting is much younger than structural fire fighting and most of its development has occurred in the last 40 years. Progress in that development can be described in various ways. It is most usual to do so historically or statistically to show progressive reduction in losses or improvement in performance. I shall attempt instead to discuss what seems to me to be the essential elements in such progress in order to take a little sharper look at the main supports on which a successful system of forest protection must depend. I think you will agree that most of these are important to all systems of protection though they may not have the same relative force.

The main supports which I would like to examine with you might be placed under the following four headings: Public education and legislation, cooperation at all levels, systematic planning, and research and development.

Public Education and Legislation

Perhaps a better term would be "public policy" since legislation bearing on fire is essentially a statement of public policy whether it be local or national in scope. Public policy is expressed and made effective only to the degree that people recognize and understand a problem and resolve to do something about it. This is the necessary background to the development of a conservation program and to the support and financing of the protection of wild land resources. In the United States people became interested in forest fires and in the damage done at the beginning of the century. Conservationists called attention to the significance of such fires and newspapers gave them considerable publicity. This created a favorable background for national legislation which set up the national forests and charged the administrators with the responsibility of protecting them from forest fires.

Our great leader in conservation, and the first chief of the Forest Service, Gifford Pinchot, was the first man to impress the need of conservation of national resources on our public consciousness. Several of our presidents have carried on that sponsorship by promoting and helping to give further legislative expression to national policy. In our conservation movement, protection of forests and other wild lands from deterioration from fire has always been a key feature.

In recent years, public education in the prevention of fires has been greatly advanced by the participation of the National Advertising Council in formulating national advertising programs. These programs featuring "smokey bear" and appealing to the general public, were begun during the last war as a free contribution to wartime public service. They have been so popular and so successful that the National Advertising Council has continued its sponsorship to the present. The objective is simple, but the stake is big. It is a full realization by the general public of the need to keep our national resources productive, and of their own personal stake in forest fire losses.

Cooperation at All Levels

Fires outdoors are no respecter of land ownership boundaries or of jurisdictions. This becomes impressed on every experienced forest fire fighter and has become one of the controlling principles of successful protection throughout the U.S.A. It was first applied by timberland owners who found that their own efforts to protect their holdings were not effective unless their neighbors took similar action. This led to the banding together of timberland owners into timber protective associations. This cooperative principle has continued in the development of forest protection. In time, since there was always some difficulty in getting uniform compliance with agreements to pool funds and efforts, four of our western States have enacted laws which provide for protection assessments against timberlands in order to facilitate the operation of both State and association protection systems. But to an increasing degree the State and Federal governments have come in as partners.

The principle of public participation in financing protection was first recognized by our Weeks law in 1911. In 1924 our Clarke-McNary law was enacted to provide Federal support of State-wide protection under State authorities. Through the operation of this law the Federal stake in forest protection was recognized and protection systems under State Foresters have developed rapidly until they are now active in 43 of our 48 States.

In spite of the accomplishments that have already resulted from recognizing that cooperation between owners and agencies is essential to any form of systematic protection, there are still a good many gaps in the scheme. This is recognized in recent efforts to strengthen wild land protection on a national basis as a part of the provisions now being set up for improving the national defense. Under it there is increased effort to provide for emergency action across State lines and to increase the cooperation between structural fire fighting groups and forest protection agencies.

The need of improved jurisdictional arrangements becomes apparent whenever a major disaster occurs. This was highlighted by the difficulties experienced at the time of the great fires in Maine in 1947. It led to the so-called New England compact by which resources of a group of our New England States are available to meet emergencies in any one of them. The provisions of the compact left the door open for adjoining States to enter into the arrangement and I understand it is hoped that the adjoining Canadian provinces may find it desirable to enter into these compacts in some way along the international boundary.

From first-hand experience in the Northwest I know that wholehearted cooperation across the international boundary has been a long established custom in fire fighting and so few jurisdictional problems have arisen that so far no one has taken the trouble to codify the legal aspects.

Cooperation, of course, extends much further than cooperative arrangements between jurisdictional units. In a large sector of our western country the active cooperation of local residents in

preventing fires, reporting them, and participating in their control, has long been the backbone of a protection system by which forest fire losses are kept to a minimum at a very low protection cost. This again represents cooperation on the ground, which is, after all, the essence of any cooperative arrangement. Much of the value of forest fire prevention publicity is in the degree to which it stimulates cooperation on the part of the general public in the effort to prevent fires or to control them before they become dangerous.

Systematic Planning

All fire fighting has a special emergency character that makes it different from most civilian activities. This is because fires start and spread at unpredictable times and places and it is impossible to schedule the need of any fire fighting activity to the degree that can be done in most forestry activities and on construction jobs. Consequently, the only way that systematic protection can be carried out successfully is through careful planning. Such planning has to address itself to the question of determining the places and times of year when effort will be needed to control fires and to the relative amount of effort that will be required in order that the fire organization may be maintained in reasonable relation to the job that will need to be done.

Planning has to concern itself with providing protection to large areas of land and to getting effective action on fires wherever they may occur. There are many phases to it and I shall not dwell on the different kinds of planning that are involved. I think it is sufficient to say that effective control of fires, regardless of the lands or the effort involved, is impossible unless a great deal of planning has been done to provide fire fighting forces at the right time and at the right place to control all fires that start.

Research and Development

From the very beginning the development of successful forest protection has depended on factual information. It is necessary to know a great deal about the occurrence of fires in every locality, the times of year when they become dangerous, and the damage they do before the requirements of the fire fighting job can be fully appreciated. Fire statistics play a big part in supplying such information but they always require analysis and interpretation before the question of what to do can be resolved.

The need of factual information for every area protected applies not only to the planning and maintaining of the organization but to its day to day operations as well. Study of the relation of weather to forest fires has enabled the development of so-called fire danger ratings which provide a daily guide to the fire control administrator in managing his organization. Fire danger ratings in the U.S.A. are imperfect in many respects and vary a great deal in their significance but have proved so valuable to the administra-

tor that they are in use in all of our national-forest regions and by a majority of the State organizations.

Research in forest fire behavior has also provided the essential base for training fire fighters and in developing the judgment of men in the planning and managing of large fire fighting operations. There is still a long way to go before we can predict just what a fire will do in all circumstances and we particularly need some new research in the behavior of big fires.

The most important thing of all in the research activity is the creation of an attitude of mind where new ideas and new answers to old problems are constantly being sought. The existing fire research group of the Forest Service is very small and their independent efforts might have little significance except as they are backed by strong demands by some of our research-minded forest administrators who are constantly looking for better methods and who are carrying on administrative studies to find out as many things as possible for themselves. Some of the most important research is not academic in nature but consists of the ability to break way from the conventional in order to arrive at a better solution.

Much ingenuity has been directed toward the problem of bringing machine methods to bear on forest fire fighting. Such development has been closely coupled with other forms of research and, in the Forest Service, was under the leadership of Mr. David Godwin for many years. He was responsible for establishing a definite continuing program of equipment development and application under the difficult situations usually encountered in forest fire fighting in rough inaccessible terrain. The benefits of giving special attention to the adaptation of equipment to the job to be done have extended from the improvement and invention of hand tools to backpack hand pumps, tank trucks, plows, tractors, radio equipment, and transportation equipment. Work in the field of equipment is dynamic, and it is never completed. One reason is that there is no ideal answer for all needs in any one piece of equipment. All of it has certain limitations. So careful testing on the ground and careful analysis of performance is necessary to find out where and when a particular piece of equipment will pay its way. We still need a great deal of this kind of work.

In recent years the most important factors that are finding their place in systematic forest protection are the best use of aircraft, including helicopters, the development of light fire trenchers, the standardization of fire tank trucks, the place of chemicals in fire fighting. The feasibility of attacking fires directly from the air is also a most attractive future promise.

Conclusions

This brief summary of the mainstays of successful forest fire protection is in outline only. Each is a story in itself. When all become well established and activity in each is maintained in step

with the dynamic nature of the job, forest protection becomes a highly successful and progressive enterprise.

But on a State- or Dominion-wide basis there may still be a serious lack in the over-all defense against fire, that is, if only city and wild land protection are well developed, and each is on an independent basis.

In the U.S.A. there are great sections of the farm and range country where no means of concerted action has been organized. In some sections volunteer fire fighters extend their protection on the city pattern into the countryside. In others, the wild land protection agencies extend their services also. But well coordinated protection coverage for city, country, and forest is still rare. This lack of coordination also shows up in equipment, training, and methods. If you have seen city firemen out battling a grass fire with ladders and chemical extinguishers or a forest crew trying to protect a structure without a pumper, you know what I mean.

Current national defense plans provide a fine opportunity to advance fire protection on all fronts. If they are properly drawn to meet large-scale fire emergencies, all protection forces will find themselves partners. Such a partnership could be highly profitable if it results in a new unity in a common purpose, more complete coverage in protecting our national wealth, more pooling of the effort in research and development, and more exchange of the "know how" that means better performance down the line.

Do Diesel Locomotives Set Fires?

There is definite evidence that Diesel locomotives do set fires. During the period April 7 to July 11, 1951, Diesel locomotives set 33 fires along the Great Northern Railroad right-of-way, according to information from the Snoqualmie National Forest, Seattle, Wash. In addition, a comparable number of fires were set on the State protective area.

Investigation of these fires, and contact with railroad officials established the following facts:

1. More than one locomotive was involved—two, at least, and possibly four.

2. All fires were started on the east-bound run while the locomotives were laboring on an up-grade.

3. The railroad officials accepted without question the theory that the fires started from sparks.

4. In previous seasons, these same locomotives had not been known to have set fires.

What was wrong? The railroad company was concerned. The one thing they knew about was that a different type of lubricating oil—highly detergent—was being used. A mechanical engineer and an oil company expert were called in for consultation. The fire-setting locomotives were given a complete overhaul, and a different type of lubricating oil was used. The locomotives went back into service. No fires have been reported since.

The explanation in this case would seem to be that the detergent oil was doing exactly what it was intended to do—loosen carbon. When the locomotives encountered a steep grade, pieces of carbon broke loose and were emitted from the stacks.—Division of Fire Control, *Region 6, U.S. Forest Service.*

INFORMATION FOR CONTRIBUTORS

It is requested that all contributions be submitted in duplicate, typed double space, and with no paragraphs breaking over to the next page.

The title of the article should be typed in capitals at the top of the first page, and immediately underneath it should appear the author's name, position, and unit.

Any introductory or explanatory information should not be included in the body of the article, but should be stated in the letter of transmittal.

Illustrations, whether drawings or photographs, should have clear detail and tell a story. Only glossy prints are acceptable. Legends for illustrations should be typed in the manuscript immediately following the paragraph in which the illustration is first mentioned, the legend being separated from the text by lines both above and below. Illustrations should be labeled "figures" and numbered consecutively. All diagrams should be drawn with the type page proportions in mind, and lettered so as to permit reduction. In mailing, illustrations should be placed between cardboards held together with rubber bands. *Paper clips should never be used.*

When Forest Service photographs are submitted, the negative number should be indicated with the legend to aid in later identification of the illustrations. When pictures do not carry Forest Service numbers, the source of the picture should be given, so that the negative may be located if it is desired.

India ink line drawings will reproduce properly, but no prints (blackline prints or blueprints) will give clear reproduction. Please therefore submit well-drawn tracings instead of prints.


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